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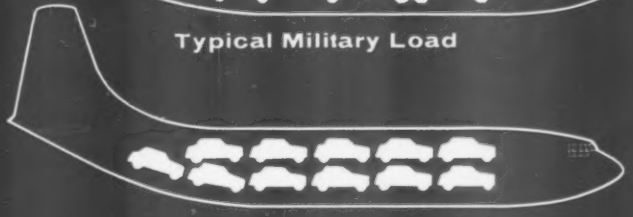

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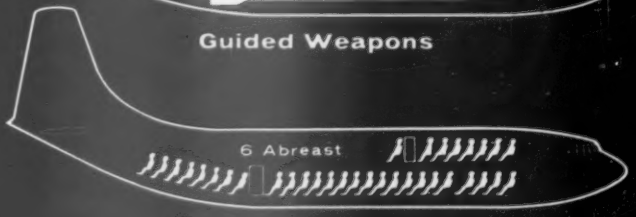

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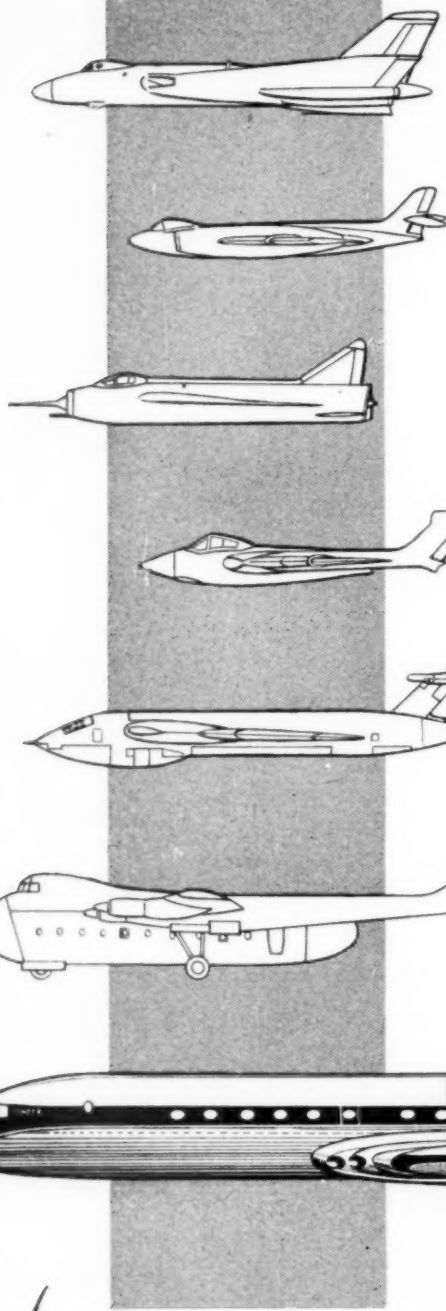

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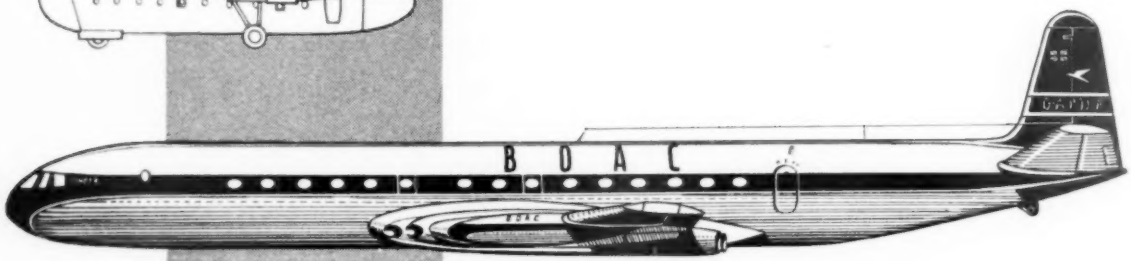

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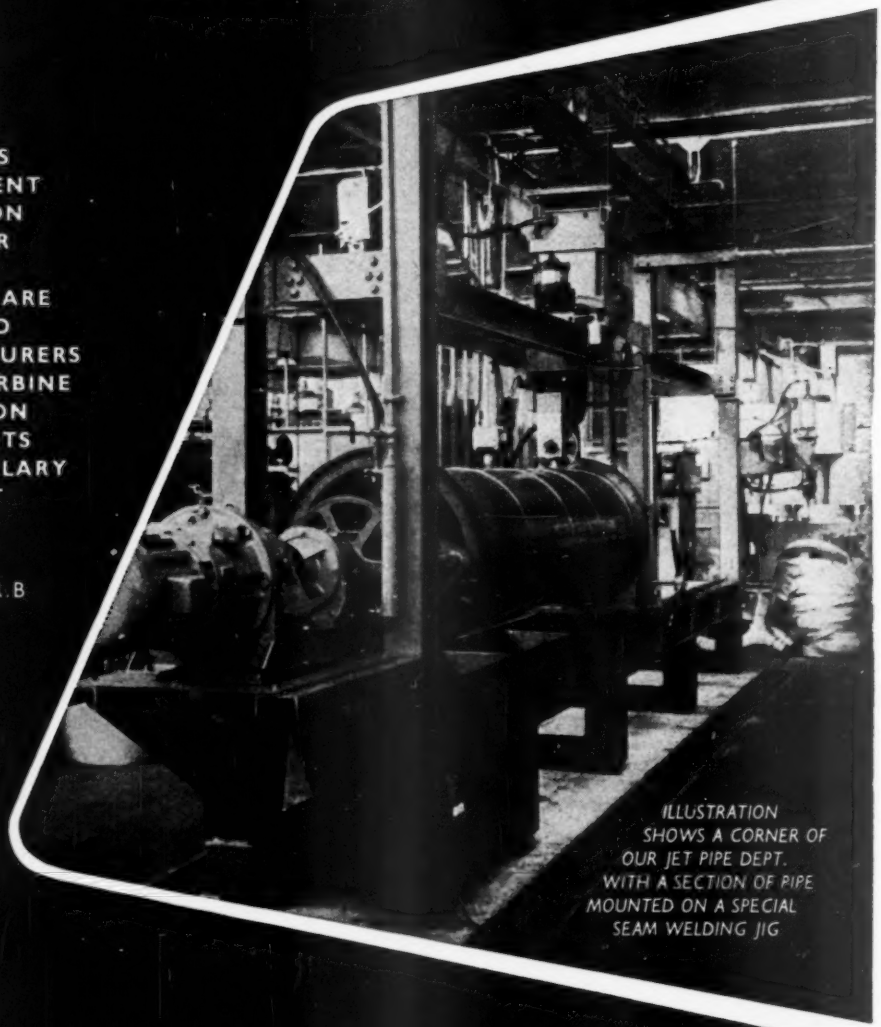

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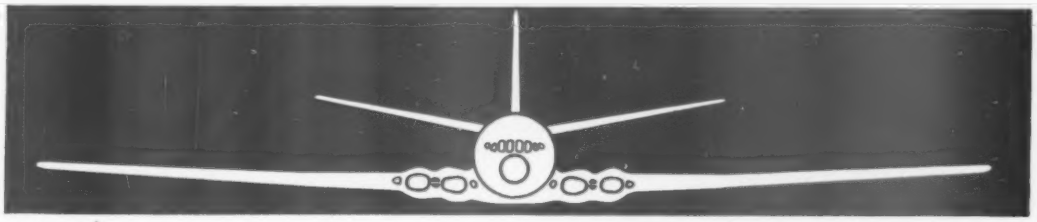

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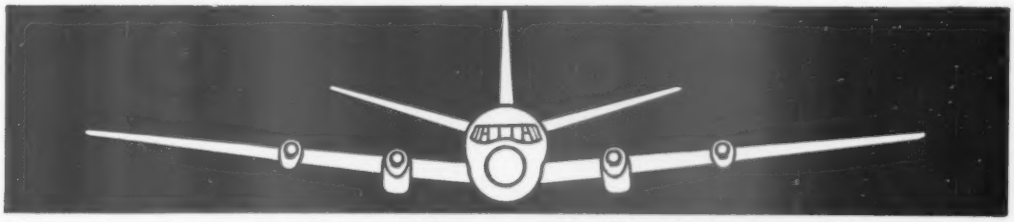

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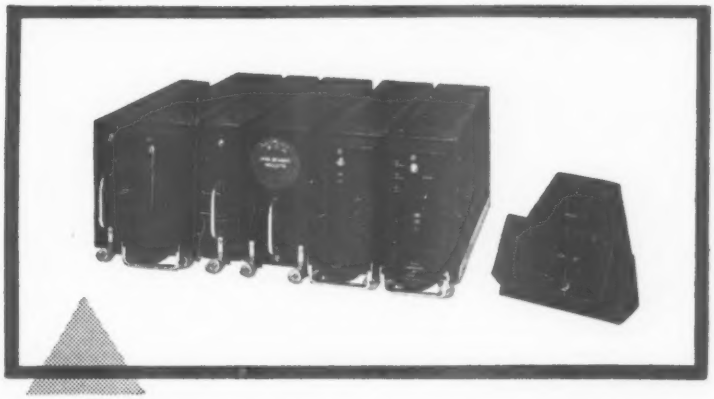

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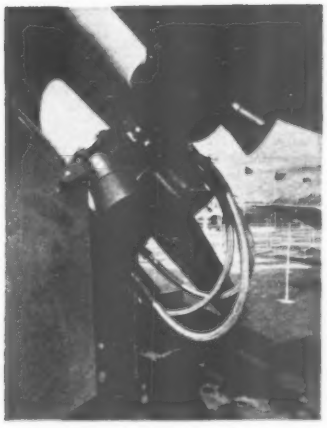

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THE AEROPLANE and ASTRONAUTICS

VOLUME 97 NUMBER 2513 DECEMBER 18, 1959

Breaking Strains

Leading articles in daily newspapers and articles in serious magazines of opinion have ensured that everyone who is the slightest bit interested shall know that the re-shaping of the Aircraft Industry to the plans of the civil service is proving a tumultuous business. It now seems possible that the new Minister of Aviation will make a statement before the House rises for the Christmas recess. In consequence, there is keen speculation as to what Mr. Sandys will say.

This is not the first time that those in current control of this country's destiny have decided that as a country we must be content with a smaller aviation industry. There was a time between the Wars when the aircraft factories were building almost everything except aircraft. And then sure enough came the insistent demand to expand.

Today the exports of the Industry have been running at a very high figure and so employment has been maintained. As the orders run down so will the political pressure to re-employ the labour become more intense. It has long been evident that the decision to curtail the supply and development of manned aircraft to the R.A.F. would vitally affect this position. Yet the Government know they must ensure that the country retains an aircraft industry. It is already clear that the more effective the nuclear stalemate the more important are armies and conventional weapons. Nobody today would dare say in these circumstances that we shall never want manned aircraft again.

It is against this background that the tremendous efforts to equate the Government's supply of carrots against the Industry's reluctance to merge must be viewed. As things are going it looks as though one of the most promising of British potentialities, the Fairey Rotodyne, is going to fall by the wayside. It would not be the first tragedy to happen because of Government delay in finalizing a contract.

Grossest Folly

Most of us remember the learned gentleman, a professor if we recollect aright, who in the early days of steam was able to demonstrate mathematically that no steamship could carry enough coal to cross the Atlantic. In our time we have heard learned fellows of our most erudite aeronautical body in solemn conclave approve the findings of various eminent colleagues that 130 m.p.h. was the economical cruising speed for commercial aircraft, that retractable undercarriages were an unwarrantable complication and variable-pitch airscrews not worth the bother.

Thus, when the Advisory Council on Scientific Policy says that this country is not wealthy enough to afford space research on the grand scale, and should be content with a modest programme of £200,000 p.a., we are not convinced that this is the end of all likelihood of space research and exploration by British engineers and scientists. If there are those who do not agree with our view, they might consider the remarks of Sir Solly Zuckerman, not only a distinguished member of the Advisory Council for Scientific Policy, but also scientific adviser to the Ministry of Defence. When interviewed on the B.B.C.'s "At Home and Abroad" on Dec. 8, he said that the space research programme was, in effect, a pilot programme. "It may well be," he continued, "that the force of public opinion is going to demand more—I don't mean the public opinion of the adults at this moment but the young adults who are coming up and who will see what's happening in other countries."

We shall be surprised if we have to wait even for the next generation before this country sets vigorously about the job.

Editor - - - THURSTAN JAMES
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Matters of Moment

Closer Links with Europe

COLLABORATION between the aircraft industry in this country and those in Europe is strengthening, so much indeed that it would be an embarrassment to list all examples of it. Following the announcement reported by us last week of a new link established in the aero-engine field between Germany and this country, an announcement was issued on December 12 from the Ministry of Aviation concerning the three-day visit of the French Air Minister, M. Jean Blancard, during which he talked with Mr. Duncan Sandys.

In the course of his tour our French visitor went to Derby to see Rolls-Royce; at Filton he saw the aircraft and guided weapon activities of Bristol Aircraft. At Bedford he flew in an aircraft of the B.L.E.U. and inspected the N.G.T.E. at Pyestock. Following his visit, which was to return that made by Mr. Aubrey Jones, when Minister of Supply, to France last summer, an official statement said:—

"The two Ministers were agreed upon the value to both countries of collaboration in the field of aviation. With a view to avoiding duplication of effort and in order to reduce the heavy costs involved in the development of modern aircraft and guided missiles, they decided to encourage still closer contact between Government aeronautical establishments and between aircraft firms in France and Britain."

Ten Million Turbine Hours

TODAY, December 18, a remarkable achievement is celebrated by Rolls-Royce with the completion of the first 10,000,000 hours in airline service by the company's turbojet and turboprop engines. This grand total represents more than 85% of the flying done by all civil gas turbines throughout the World. And in gaining this unique experience Rolls-Royce turbine powerplants have flown no fewer than 2,500 million engine miles (4,000 million km.)—which is equivalent to 5,000 round trips to the Moon.

In the announcement of their achievement, Rolls-Royce point out that the other 15% of World civil turbine flying is shared between four different engine manufacturers. They disclose that every 7.3 seconds another flying hour by Rolls-Royce civil gas turbines is logged; and every 30 seconds, day and night, seven days a week, one of the 490 Rolls-Royce-powered airliners that are now in service takes off somewhere in the World.

Rolls-Royce's 10 million flying hours have been accomplished by Dart turboprops in Vickers Viscounts, Fokker Friendships and Fairchild F-27s; and by Avon turbojets in de Havilland Comet 4s and Sud Aviation Caravelles. They have been flown on long-, medium- and short-range routes by 58 airlines in six continents; and 4½ million hours have been flown in North America.

Individual engines have flown more than 9,000 miles and some "hot" components have achieved up to 8,000 hours without repair. Overhaul life of the Dart turboprop started at 400 hours and has now reached 2,500 hours, the highest ever approved for any aero-engine. At this figure a Dart engine flies an average of 625,000 miles (1,000,000 km.) between overhauls. The Avon—embodying much of the experience learnt from the Dart—started at 1,000 hours between overhauls and after only 12 months in service this was increased to 1,600 hours, during which period the engine flies over 700,000 miles (1,126,500 km.). During the whole overhaul life no scheduled component changes or internal inspection are required.

Personal Flying in Parliament

REPLYING last week to an Opposition question to the Minister of Aviation on what steps he is taking to encourage private flying in Great Britain, the Parliamentary Secretary, Mr. Geoffrey Rippon, said that the Government helped private and club flying by landing concessions at certain State aerodromes; by reduced rates for housing and parking; the rebate of petrol tax for club aircraft; payment for use of club facilities by the Air Training Corps; and moderated airworthiness arrangements. The Standing Joint Committee on Private and Club Flying has prepared a specification for a cheap VHF radio set and is preparing another for an economical light aircraft.

His questioner, Mr. Collard, was not reassured, and asked whether Mr. Rippon knew that in spite of this assistance, private flying and flying clubs in general were in a bad way? Did he agree that perhaps one of the best ways of helping flying clubs would be to enable them to buy new aircraft, and that this in turn might have the effect of creating a market for light aircraft in this country, where at present it does not exist?

Mr. Rippon was not prepared to agree that the clubs were in a bad way. Everyone was well aware of the importance of giving every encouragement to private flying.

The interchange, however, ended on a rather ominous note when Mr. de Freitas asked the Parliamentary Secretary for an assurance that there would be no change in the petrol rebate. Mr. Rippon replied that the matter was now under consideration.

New Metals from I.C.I.

IN a week when disturbing statements were being made about the part Britain should play in astronautical developments, it was good to be able to see something of the effort that is going into the development and production of new metals in this country. Beryllium, niobium and hafnium have all been mentioned as possibilities for certain astronautical applications. And last week, I.C.I. disclosed some of the work that is being done in this direction at its Metals Division at Witton, Birmingham, where Britain's first beryllium production plant is now operational.

At the present time this plant—which employs about 200 people on a two-shift basis—is devoted entirely to the output of beryllium fuel cans for the U.K. Atomic Energy Authority; it was in fact built specifically for that purpose. But, no doubt, at some future date should there be a demand for beryllium for other purposes the I.C.I. plant could meet it. Its present

THEN.—The first service from London, run jointly by Imperial Airways and Qantas Empire Airways, left Croydon on Dec. 8, 1934, and was scheduled to arrive in Brisbane on Dec. 20. The first service from Australia left Brisbane on Dec. 10 and was due in London on Dec. 24. Here is "Hengist" leaving Croydon airport on Dec. 8 with the Antipodean mail bag, after a ceremony in which the Secretary of State for Air, Lord Londonderry, handed letters from the King and Queen and the Prince of Wales to the Postmaster-General, Sir Kingsley Wood, for franking.

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NOW.—To celebrate the Jubilee of the B.O.A.C. (formerly Imperial Airways) and Qantas Empire Airways partnership a party took place in London on Dec. 10. L. to R. Mr. Basil Smallpeice (managing director, B.O.A.C.) and Mr. C. O. Turner (chief executive and general manager, Q.E.A.); Sir Gerard d'Erlanger (chairman, B.O.A.C.) and Mr. Duncan Sandys (Minister of Aviation). Extreme right, a Short Empire flying-boat took pride of place in the model display, as it still does in many travellers' minds.

production of wrought beryllium is of the order of 7-10 tons a year.

As a low-density material with a high elastic modulus, beryllium is particularly attractive for a number of aeronautical uses. It is already being employed in the United States for certain aircraft and guided missile equipment. However, production of the wrought metal involves a complex process and the raw material is comparatively scarce—and both these factors contribute to a high cost; the present World price for wrought beryllium is in the region of £160 per lb.

As we saw during our visit to I.C.I. last week, elaborate safety precautions have to be taken when dealing with beryllium, as the powder—in which form the raw material comes—can give rise to serious lung troubles. Special clothing is worn by all the operatives in the factory area proper and a complex air conditioning system pumps 200 tons per hour of air through the building. A check is kept by an air sampling system, some 15,000-16,000 samples being analysed each week. By these means the contamination level is kept well below the 2 microgrammes per cubic metre that can be tolerated.

Of more immediate interest aeronautically is titanium, and I.C.I.'s wrought titanium plant at Birmingham, which came into commission in 1955, now has a capacity of 2,000 tons a year. Titanium is produced by an electronic melting process using the raw material in the form of a compacted consumable electrode. The new furnaces at Witton are said to be the largest and most up to date in Europe and are capable of producing ingots weighing either 2,100 lb. or 4,200 lb. Built in West Germany, they were installed at Witton last year.

Zirconium is also produced in wrought form at I.C.I.'s Metals Division. Ingots of this material weighing up to 3 tons can be produced, although the "standard" ones are half-ton ingots. The zirconium plant at Witton has been in commission since 1958. Primarily of interest in the nuclear engineering field, the material is of particular interest also for applications—such as in chemical plant—where its high resistance to corrosion can be utilized.

Twinkling Satellites

JUST as stars twinkle because of irregularities in the lower atmosphere, so do irregularities in the ionosphere cause "twinkling" of radio waves coming in from outer space, such as the transmissions from artificial satellites. Writing in *The New Scientist*, Dr. B. H. Briggs, of the Cavendish Laboratory, Cambridge, attributes these "scintillations" to the presence of ionized clouds in the ionosphere at a height of over 200 km. They are elongated along the lines of force of the Earth's magnetic field, being about 10 km. long and 2 km. wide; they tend to occur in localized groups covering an area of about 1,000 km. in an E./W. direction by 400 km. in a N./S. direction; and they move at an average speed of 100 metres/sec. (220 m.p.h.), though they can go five times as fast during magnetic storms.

Since satellites travel so fast, the twinkles, or fluctuations, in the radio messages they send out have a period of about one-fifth of a second, when the waves pass through a series of these ionized clouds. They occur most frequently near the auroral zones surrounding the magnetic poles of the Earth, but are also found over the Equator. So Dr. Briggs recommends that satellite tracking stations, as well as radio telescopes, are best set up at about latitude 30° N. or S.

Roughly speaking, radio waves of less than 1 metre wavelength are scarcely affected by the ionosphere; between 1 and 20 metres it causes them to fluctuate, and at wavelengths above 20 metres the ionosphere is impenetrable.—A.E.S.

For the Archives

FOR future reference by members and others who are interested in the history of aviation, the Royal Aero Club is collecting aeronautical historical records. Thanks to donations of photographs, log-books, programmes, newspaper cuttings and the like, from Hedges Butler, Sir Francis McClean, John Dunville, Claude Grahame-White, and many others, the Club already owns some excellent material.

Primarily the Club is interested in matter concerning aviation pioneers, historic flights, records and sporting aviation. Technical and scientific material is being collected by the Royal Aeronautical Society and any presented to the Royal Aero Club will be given to them. Surplus material will be sold in order to finance the purchase of items of special interest.

Anyone who has any of the following items in their possession should know that they would be most gratefully received by the Royal Aero Club, and placed among its historical records:—

1. Photographs, prints, paintings, postcards, films, slides, signatures and newspaper cuttings concerning personalities, events and aircraft.
2. Programmes of flying meetings, races, rallies and dinners.
3. Old aeronautical books, journals, catalogues and manuals.
4. Aeronautical souvenirs of any description.

Any of such items, old or modern, may be sent at any time to: The Honorary Secretary-General, Royal Aero Club, 119 Piccadilly, London, W.1.

Changes at Derby

FROM Rolls-Royce comes news of some reorganization of the aero-engine design department, which is intended to "streamline" the section and to ensure continuity of design. For this Mr. F. W. Morley, B.Sc.(Eng.), A.F.R.Ae.S., A.M.I.Mech.E., becomes chief design engineer; Mr. A. H. Fletcher, B.Sc., M.I.Mech.E., is appointed design manager; Mr. D. McLean will be chief designer, by-pass engines; and Mr. D. O. Davis becomes chief designer, jet engines.

Mr. Morley has been with the aero-engine division of the company since 1938. He worked on Merlin, Griffon and Vulture design until 1940 when he moved to the Duffield Bank project office. Three years later he went to the company's Barnoldswick factory and was associated with the design of a number of Rolls-Royce gas turbine powerplants. He returned to Derby in 1947; and in 1954 was appointed chief designer, military engines—a post he has held until his present appointment as chief design engineer.

Matters of Moment . . . .

International Gathering

IT has become a pleasant annual custom for the representatives of member airlines of IATA, operating through the U.K., to entertain their friends under the auspices of the IATA Technical Liaison Office. In accord with this tradition a cocktail party was held at 35 Curzon Street, London, on December 9.

This year the party was attended by Sir William Hildred, Director-General of IATA, and Mr. F. Krsyczkowski, Technical Director of IATA. Among those present were: M. M. V. Custance, C.B. (Deputy Secretary, Civil Aviation, M.o.A.), Air Cdre. R. T. Gething, O.B.E., A.F.C. (Director, Control and Navigation, Air Ministry), Air Cdre. H. J. Hickey (Director, A.T.C. Development, Air Ministry), Gp. Capt. J. B. Veal, C.B.E., A.F.C. (Director-General Air Services, M.o.A.), Gp. Capt. G. R. Scott-Farnie (Managing Director, International Aeradio), G. Stallibrass (Director of Aerodromes, M.o.A.) and C. G. Phillips (Director of Telecommunications, M.o.A.).

The Golden "Jane's"

WITH the 1959-60 edition, published on December 16, *Jane's All The World's Aircraft* celebrates its fiftieth birthday, with the biggest volume in the series. For the first time the Aeroplane Section alone exceeds 400 pages and the total for the volume of 558 pages includes the largest section to date on Missiles and Space Vehicles. So large are these sections, and that devoted to Aero-engines, that the charts of military aircraft markings and tables of airline statistics have been dropped. These were the last remnants of the historical surveys introduced in 1922 and divided into military and civil chapters in 1928.

One feature of the Golden Jubilee edition which will be welcomed especially by amateur pilots is the inclusion of details of a large number of American home-built lightplanes and racers. The products of China and Mexico are included in the aircraft survey to bring to 34 the number of countries represented.

To mark the jubilee, the 1959-60 edition also includes an appreciation, by Oliver Stewart, of the three editors of "Jane's"—Fred Jane, C. G. Grey and Leonard Bridgman; a chronology of aviation events in 1909; and reproductions of 32 pages from the first "Jane's," published in 1909. The price is £5 5s. net.

A de Havilland Retirement

MAJOR HEREWARD DE HAVILLAND was presented with a travelling alarm clock on November 17 by the Christchurch branch of the Royal Aeronautical Society to mark his retirement from his post as general manager of de Havilland's Christchurch factory and in recognition of his services to the branch. He has long been associated with the development of the British aircraft industry and on his retirement he is going to live in Australia.

Major de Havilland, who is 65, was educated at Oakfield, Rugby and Dover. He entered the R.F.C. at the age of 19 and subsequently served in the R.A.F. He was released from the R.A.F. after the First World War with the D.S.O. In 1921 he went to Spain to represent the de Havilland company. He opened the de Havilland factory near Sydney, Australia, in 1927, and remained there until 1934 as managing director.

During the Second World War he helped in the development of the Mosquito and in placing it in squadron service with the R.A.F. He became managing director of the Christchurch factory in 1949 when it was part of the Airspeed Division of the de Havilland company. When the Division was integrated with the parent company two years later he was appointed general manager.

Safety is No Accident

CURRENT views on flight safety were given a thorough airing on December 11 at an all-day symposium organized by the Royal Aeronautical Society; its chairman was Mr. W. Tye, chief technical officer of the A.R.B. In the morning the viewpoints of the operator and the airline pilot were discussed by Capt. J. W. G. James and Capt. E. C. Miles respectively. In the afternoon the viewpoints of the accident investigator and aircraft constructor were put by Mr. P. G. Tweedie of the Ministry of Aviation and Mr. R. H. Warde of Bristol Aircraft.

So far as the operating side of the problem is concerned no more suitable pair of speakers could have been chosen than Capts. James and Miles. Both have a practical understanding of the airline pilot's problems, yet one (Capt. James) was seeing these and the question of overall safety primarily from the management viewpoint, while the other (Capt. Miles) was speaking as a regular airline pilot who is also directly concerned with the formulation of safety regulations. The opinions expressed were thus similar and yet subtly different.

Broadly, it might be said that the airline operator wants to do everything possible to ensure safety, but accepts the economic impracticability of raising the standards much higher than they are at present; the airline pilot believes that the level of safety could be higher, and kept higher, by removing all foreseeable causes of accidents. The pilot has, in any case, a vested interest in safety since he is usually the first to arrive at the scene. During the discussion, and in reply to a speaker who had said he wanted to feel as safe in an aeroplane as in his office, Capt. Miles remarked, in effect, that he wanted just the same thing—since *his* office was the flight deck.

One thing was unanimously agreed—that a better expression should be found to replace the words "pilot error" since the "error" for which the pilot was responsible might, for instance, be a basic design feature which defeated him in an emergency. Another point stressed was the value of flight-deck simulators as a means of practising emergencies and thus developing confidence. It was also suggested that these synthetic trainers might be developed to such an extent that they could correctly simulate dangerous aerodynamic characteristics.

Typical examples of foreseeable, and therefore preventable, accidents were, Capt. Miles suggested, those involving collisions (the A.T.C. problem was understood), ground stall, metal fatigue and altimeter misreading; unforeseeable accidents were those caused by human error at any level.

Mr. Tweedie said that accidents had become increasingly difficult to investigate because wreckage might be spread over 25 sq. miles at any point on the face of the globe, or might be deeply buried; total disintegration was common and wreckage equivalent to 12 double-decker London buses might be buried up to 60 ft. deep. If fire broke out accident evidence was destroyed in a matter of minutes.

He said that it would be realistic for manufacturers to assume that there would be a crash of any new aircraft either during its development or soon after entering service. He suggested that it was vital to develop and install an efficient recoverable crash recorder; this need not be a complex flight recorder, but a simple, robust device recording perhaps six parameters. Other suggestions were that aircraft structures should be colour-coded internally—for example, red for the port wing and green for the starboard one—so that wreckage could be more easily pieced together; that fire and impact protection should be provided for black boxes whose internals could give useful evidence on a crash; and that there should be mechanical indication of main control positions because remote electrical indicators rarely gave valuable information after a crash.

Mr. Warde stated his personal view that it was more important to increase flight safety than aircraft speed. Until recently a broad code of airworthiness requirements had existed before design began, but now there was a problem: would new aircraft be designed and airworthiness requirements tailored to them?

The symposium ended with a general discussion. In this Capt. James spoke about human error, saying that the difficulty arose when things became commonplace. He was never worried when he sent an aircraft over a new route for the first time; the difficulty came later when the crew mentally put their feet on the dashboard—it was then that they might tune into the wrong beacon or land at the wrong aerodrome. He suggested that the philosophy of management might be changed on big aircraft and that they might need "one person at the front end of the aircraft just to administer that part of the aircraft." He reckoned this could not be done if this person also had a piloting function to perform.

A point emphasized in the discussion was the great need for information about flight incidents to be disseminated right down to junior draughtsman level in companies. A Boscombe Down speaker mentioned a recent flight incident in which fuel from tank vents had entered an engine bay and caused a fire; this possibility had been mentioned to the company 2½ years ago [and a similar cause of disaster was experienced more than 10 years ago with the DC-6—ED.].

General Aviation News

EAST-WEST SPACE PLAN. — On December 12, the United Nations Political Committee recommended that the General Assembly should set up a 24-nation group to promote the peaceful exploration of space. It was also urged that next year, or in 1961, an international conference should be held "for the exchange of experience in the peaceful uses of outer space."

SPACE DISPOSAL.—During a debate in the House of Lords on November 24, Lord Shackleton suggested that radio-active waste should be put "somewhere in outer space." One of the first uses for vehicles that go into outer space should be to dispose of our own planetary poisons, he said.

THORS OPERATIONAL. — Thor IRBMs based in Britain have now been declared operational. The R.A.F. has four Thor squadrons, each with 15 missiles, based in eastern England.

SPUTNIK DETECTOR. — The destroyer "Vendetta" of the Royal Australian Navy has been fitted with special equipment to record signals from the Soviet satellite, Sputnik III. Experiments are being made in co-operation with the Radio Research Board of the Australian Scientific and Industrial Research Organisation to aid studies of the ionosphere.

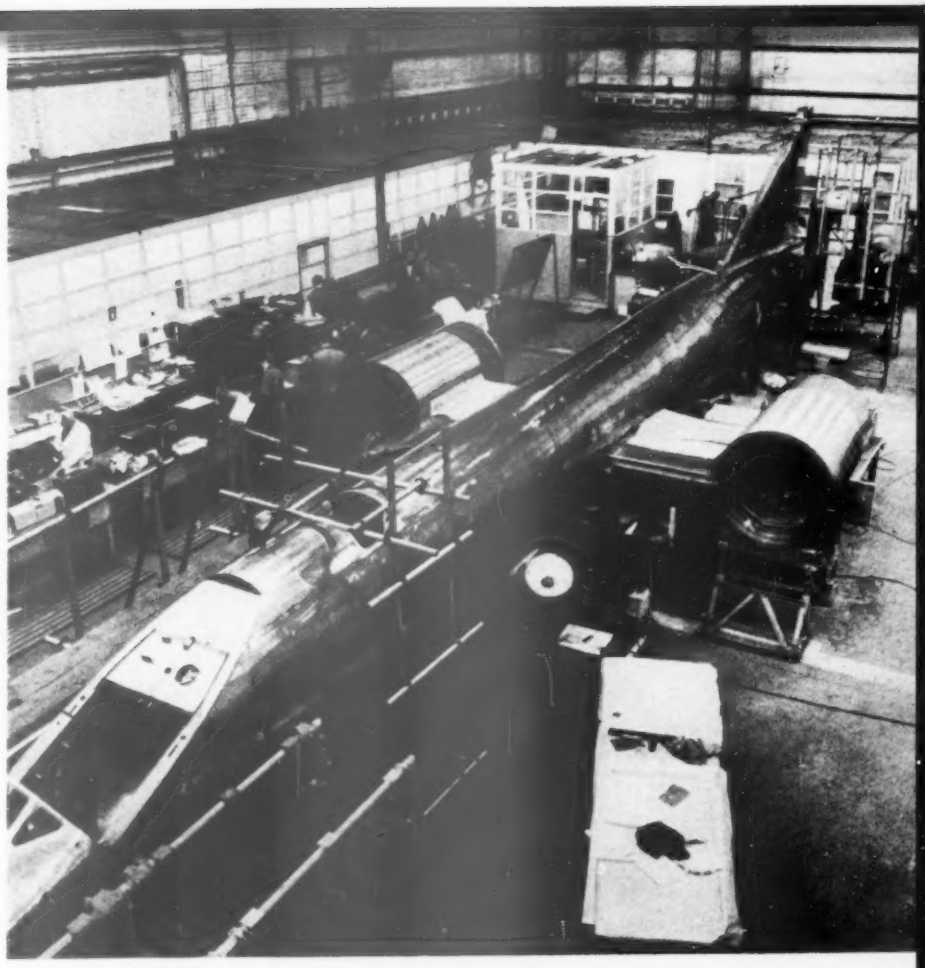
SPACE PAINT.—A new product that reduces the extreme heat to which space vehicles are subjected on re-entry into the Earth's atmosphere has been announced by the Emerson Electric Company of St. Louis, Missouri. Mr. Rubin Feldman, who developed the material, says that it cuts down the heat input by a process known as "bulimation"—the transition of a solid into vapour or gas without an intervening transformation into liquid. The product, called Thermo-Lag, can be applied like paint by a spray gun to metal and is now being tested on Minuteman, Polaris and other missiles.

ALTIMETER TEST.—The F.A.A. is to test the Standard STR 30-31 FM radio altimeter as part of a programme to evaluate new American and foreign equipment. Contract is valued at $13,425.

MORE VISCOUNTS . . . Austrian Air Lines (AUA) is to purchase four Viscount 810s from Vickers. Formal Parliamentary agreement for the order is expected by the end of this year. AUA will also retain two of the four Viscount 779s chartered from Fred Olsen.

. . . AND CARAVELLES.—Sabena has ordered four Caravelle VIs, for delivery in February, 1961, plus an option on four more. The Caravelle VI has 12,200 lb. s.t. Avon 531 engines and a gross weight of 103,600 lb.

FAST F-105.—The U.S.A.F. is claiming a new record for the 100-km. closed-circuit with a speed of 1,216 m.p.h. set up on December 11 by a Republic F-105 Thunderchief. This was flown by Brig. Gen. Joseph Moore from Edwards AFB, and exceeded the previous record of 1,100.426 m.p.h. set up by the French Griffon II.



STEEL PROTOTYPE.—The Bristol 188 supersonic research aircraft in the experimental shop at Filton. This all-steel aircraft is scheduled to make its first flight next year; details were given in THE AEROPLANE AND ASTRONAUTICS for December 11.

FACILITATION MEETING.—More than 30 nations are represented at the I.C.A.O. Facilitation Division's fifth session, which began in Rome on December 1.

GHANIAN HT-2S.—The Ghana Air Force, which is staffed by Indian instructors, is to be equipped with Hindustan HT-2s for *ab initio* training. The first aircraft are already being shipped.

DHC CONTRACTION.—De Havilland Canada is reducing its works force by 400 because of diminishing orders for Beavers and Otters, which are operating in 62 countries. Work is continuing on the 100 Trackers for RCN, and so far there have been about 17 orders for the new Caribou.

GERMAN F-104 ORDER.—The West German Air Force is to acquire a further 364 Lockheed F-104G Starfighters in addition to the 296 already ordered. Some of the additional 364 fighters as well as 200 of the original order are expected to be built in Germany and the remainder in North America. By about 1966 the only German Air Force fighter bombers will be F-104s and Fiat G-91s.

CARRIER RECORD?—A Douglas A3D-2 Skywarrior has set what is believed to be a new record for carrier-based aircraft by taking off from a carrier at a gross weight of 84,000 lb. Minimum airspeed at lift-off from the deck was approximately 143 kt. The tests were made to show that launching at this weight was possible with no wind except that generated by forward motion of the carrier.

CHEAPER U.K. FARES.—B.E.A. is to introduce cheap domestic night flights next April. Early morning and late evening flights from London to Belfast, Edinburgh and Glasgow will be £2 10s. to £3 less than day fares, and night flights to Manchester will save 29% (£2 5s.).

F-106 IN SERVICE. — The first U.S.A.F. F-106 squadron became operational on October 31; it is the 498th Fighter-Interceptor Squadron based at Spokane, Washington.

HELICOPTER ORDER.—Kaman Aircraft has received a U.S.A.F. order for an additional 42 H43-B Huskie rescue helicopters. This brings the total on order to 111.

BOAT SHOW SPECIAL

A CONSIDERABLY enlarged January issue of our associated journal *The Motor Boat and Yachting* will be published on December 30, the opening day of the National Boat Show. The principal feature of this issue will be a comprehensive review of the exhibits at the Show, illustrated with numerous photographs and sectional and perspective drawings. Supporting articles will describe in detail new cruisers, motor yachts and work boats.

Commercial Aviation Affairs

M.M.A. FRIENDSHIP.—Latest Fokker Friendship delivery to Australia is this one for MacRobertson Miller Airlines, purchased through T.A.A. This is the 27th Fokker-built F.27; orders now total 136 and 100,000 flying hours have been amassed.

PILOT PAY PROBLEM.—B.E.A. pilots have refused to fly the Comet 4B on passenger services until their claim for more pay and shorter working hours has been settled. Regular Comet services are not to begin until April, 1960, but the pilots' decision may prevent the *ad hoc* use of Comets on scheduled services which was to have begun this week.

AIRLINE RESERVES.—The F.A.A. has extended for one year (to October 23, 1960) its regulations for reserve fuel to be carried by jet aircraft flying outside the U.S.A. Fuel must be carried for: an approach to destination and climb back to cruising altitude; flight to the most distant declared alternate; holding for 30 minutes at 1,500 ft. over the alternate; and 10% of fuel required for the scheduled sector to be flown. The relevant F.A.A. document is SR-427A.

AUSTRALIAN FRIENDSHIPS.—T.A.A. has disposed of three of the 12 Fokker F.27s which it ordered in two batches of six each. The Australian Government arranged for T.A.A. to overbuy in order to make F.27s available to smaller operators at low prices. One F.27 each has been sold to MacRobertson Miller Airlines and Broken Hill Pty., Ltd., and another is leased for one year to East-West Airlines, with an option to buy later. T.A.A. has provided E.W.A. and M.M.A. with pilot and engineer training and is also providing overhaul facilities and a relief aircraft.

MONTREAL-ROME LINK.—Canadian Pacific Airlines will extend its Montreal-Lisbon service (with Britannias) to Rome on March 1. The twice-weekly service will be the first direct link between Italy and Canada.

UNIONS UNITE.—Eight U.S. trade unions representing airline pilots, flight engineers, cabin staff, flight dispatchers, transport workers, machinists, railway clerks and auto workers have formed the Association of Air Transport Unions (AATU) to co-ordinate economic, legislative and industry activities.

INDEPENDENT DECCA.—Don Everall (Aviation), Ltd., is to fit Decca Navigator equipment in two of its aircraft. Other independent operators now using Decca include B.K.S. and Jersey Airlines, in addition to Silver City Airways.

OCTOBER TRAFFIC.—The M.o.A. estimate of traffic carried by U.K. airlines on scheduled and inclusive tour services in October indicates a 44% increase over October, 1958. Last year's result was influenced by the B.O.A.C. strike. Capacity offered increased by 32% and the overall load factor went up from 55% to 63%.

THAI PROGRAMME.—Thai Airways International—THAI for short—will start operations on April 1, 1960, over a route from Bangkok to Hong Kong, Rangoon, Calcutta, Singapore, Kuala Lumpur, Pnompenh and Saigon. S.A.S., joint owner with Thai Airways Co., will provide three DC-6Bs on lease, plus captains and training facilities.

OSLO NOISE BAN.—After making noise tests, the Norwegian authorities have refused permission for B.E.A. Comets and S.A.S. Caravelles to operate from Fornebu Airport, Oslo. The decision will be reviewed in 1962 when a new runway is completed.

S-61 ORDER.—Chicago Helicopter Airways has ordered six Sikorsky S-61s for service in 1961. Powered by two General Electric T58 1,250 s.h.p. gas turbines, the C.H.A. S-61s will carry 25 passengers plus freight. The cost of a fully equipped S-61 has been given as approximately $650,000.

B.E.A. FARES CUT.—All B.E.A. fares to Gibraltar and Malta, except week-end day flights between mid-June and the end of October, will be reduced by up to 25% from April 1. Cheapest of the new fares will be on mid-week night flights: £33 13s. (instead of £42) return to Malta and £32 (£38 15s.) return to Gibraltar.

News About People

SILVER CITY APPOINTMENT.—Mr. George Roberts has been appointed superintendent of Silver City air ferry operation in succession to Mr. R. G. Macrae. He joined Silver City in March, 1951, as operation officer at Lympne and has served in a similar capacity at Ferryfield since 1957.

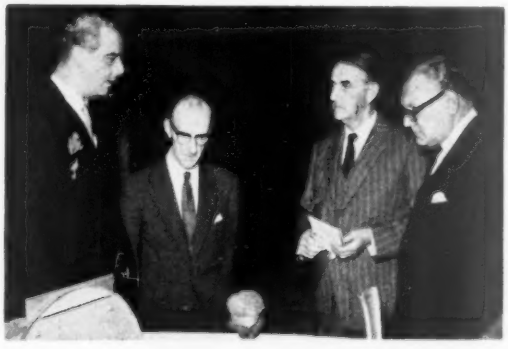
JOINING FOLLAND.—Mr. Maurice Brennan, formerly chief designer of Saunders-Roe and now assistant chief engineer of Vickers-Armstrongs (Aircraft), is joining Folland Aircraft—now a member company of the Hawker-Siddeley Group—early in the New Year, as a director and chief engineer.

NEW DIRECTORS.—Two new appointments to the board of Flight Refuelling, Ltd., have been made. Mr. A. W. Goodliffe, for many years chief designer, has now been appointed chief engineer; and Mr. J. E. Burnett, who has recently joined the company, has been appointed works director. Mr. Burnett was previously director and general manager of Helliwells, Ltd.

R. A. FRAZER.—We regret to record the death, at his home at Ockham, Surrey, on December 10, of Mr. R. A. Frazer. A well-known authority in the field of aeronautical research, Mr. Frazer was, at the time of his death, a member of the oscillation sub-committee of the Aeronautical Research Council. He retired in 1954 as deputy chief scientific officer in the aerodynamics division of the N.P.L.

Above, new directors of Flight Refuelling, Mr. A. W. Goodliffe (left) and Mr. J. E. Burnett.

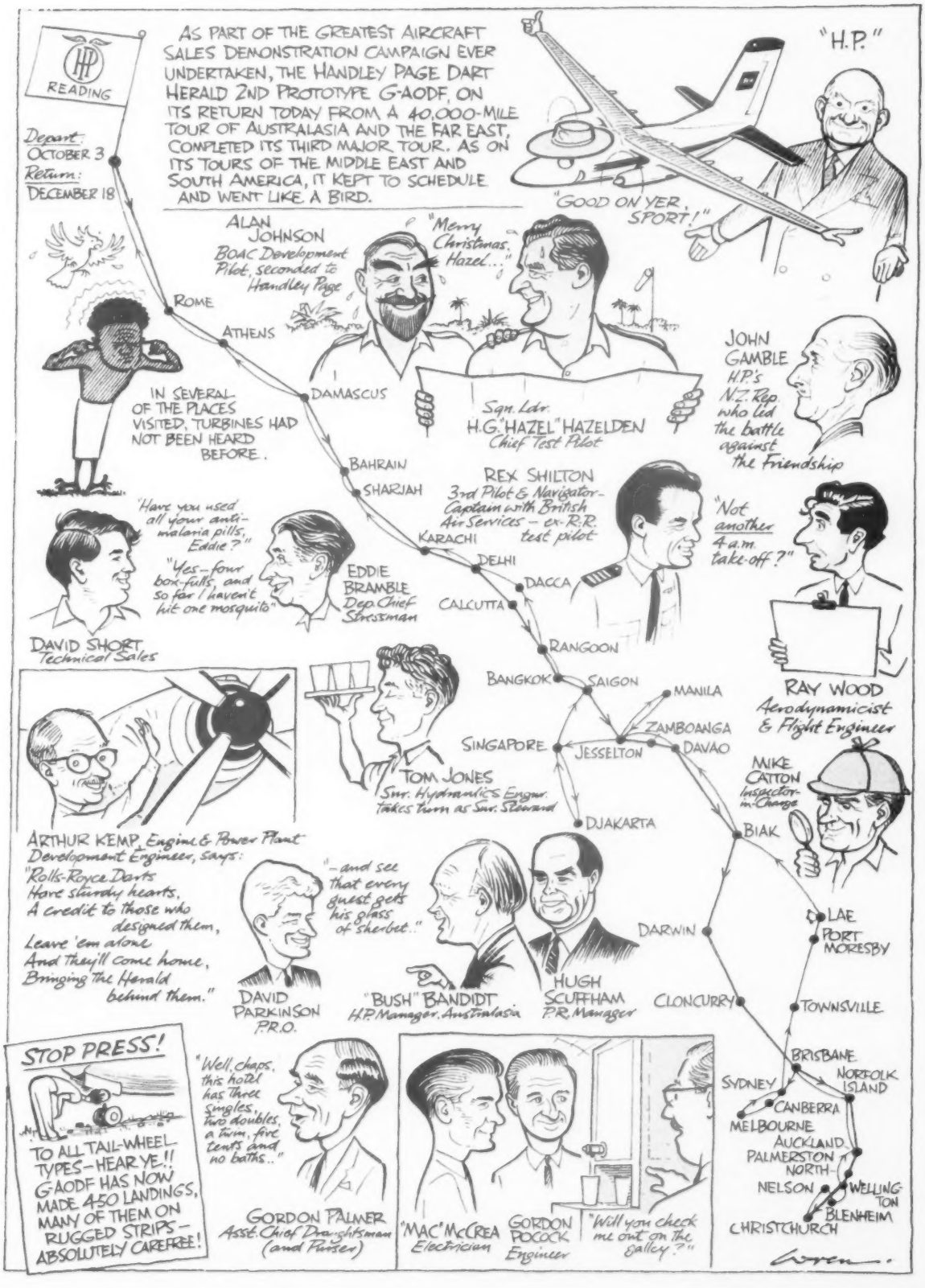
Right, The Rt. Hon. George Ward, Secretary of State for Air, recently visited Hawker Siddeley Aviation. With him here are (left to right) Mr. E. T. Rowe, Sir Sidney Camm and Mr. J. T. Lidbury.



BOEING IN LONDON.—Robert S. Mansfield, new manager of public relations (Europe) for the Boeing Airplane Company, arrived in London on December 10 to open a public relations office for his company in this country. Boeing is the first of the major American aeroplane companies to open such an office in London.

T.C.A. DIRECTOR.—Air Vice-Marshal Clifford M. McEwen has been appointed a director of Trans-Canada Air Lines in succession to Mr. C. P. Edwards, the former Deputy Minister of Transport.

Heraldic Wroundabout



Air Transport

Pilot Age Limit

WITH the support of the airlines and opposition from the pilot's union, the Federal Aviation Agency has ruled that commercial airline pilots must retire from active flying duty with U.S. airlines at the age of 60. The rule will become effective on March 15, 1960, and is expected to apply immediately to about 40 senior captains, many of them on jet aircraft.

When the F.A.A. proposed this regulation earlier in the year, it also indicated that it would rule against pilots converting from piston to jet transports after they were 55. A public hearing into this proposal will be held on January 7. Additional regulations have been introduced concerning airline pilot training programmes, which in future must be approved by the F.A.A. and must give more attention to the training of co-pilots.

B.O.A.C. Arctic Plans

A C.A.B. examiner, after considering B.O.A.C.'s application for permission to operate a service on an Arctic route between London and the U.S. west coast, has recommended that the appropriate route rights be granted. The London-Los Angeles route was added to the U.S.-U.K. 1946 Air Services Agreement in 1955, but C.A.B. and Presidential approval is needed before any new service to the U.S. can be operated. Pan American Airways already flies services between Los Angeles, San Francisco, Portland and Seattle, on the west coast, and London, using the Boeing 707 Intercontinental.

According to the C.A.B. examiner, B.O.A.C. proposes a twice weekly service with Boeing 707s having 56 de luxe and 63 economy class seats. The Corporation estimates that it would achieve 50% load factors and would carry 2,900 de luxe and 3,300 economy class passengers a year in each direction.

The service is expected to start in February, 1961, after the 707 has been firmly established on B.O.A.C.'s North Atlantic routes. Frobisher will be used as a refuelling point eastbound and, when necessary, westbound. With the help of the prevailing westerly winds, the 4,727-naut.-mile Los Angeles-London sector should be within the Conway-engined 707's reach on a reasonable number of occasions.

An important part of B.O.A.C.'s plan is that this route should eventually be extended to Sydney, connecting with the San Francisco-Tokyo-Hong Kong services at Honolulu. This will almost match the Pan American service which, after flying over the Arctic route from London, is continued through San Francisco to Tokyo.

More Length at London

WORK is to start at once on the extension of the 10R/28L runway at London Airport to 11,000 ft. Already the longest runway (9,576 ft.), 10R/28L is one of the two instrument runways. It will be extended to the west, requiring the perimeter road to be diverted.

The work will be scheduled to permit the runway to remain open at least until September, 1960, and the extension is to be completed by the spring of 1961. The opportunity is to be taken to improve the approach and runway lights on 10R/28L, and generally to bring the equipment up to date.

The Air-freight Business

WHENEVER the agreed IATA fares or rates are lowered for some sector in the business of air transport there follows an amusing exercise in public relations. Many of the airlines concerned send out individual news releases, or information circulars, to say that their own rates have been reduced. "Our Fares Lower than Ever," or "XYZ Airlines Reduces Freight Rates Again," or "Down Go ABC's Cargo Rates," say the releases—with never a mention of the IATA struggles which preceded the changes, or of the fact that *all* the airlines' fares or rates have changed.

It is natural enough, one supposes, that each individual carrier should wish to pretend that it is a sharply competitive airline whose ruthless efficiency has led to these vital cuts for the benefit of the customers.

Last month there was a little spate of circulars about the North Atlantic cargo-rates changes which were agreed at Honolulu and which come into force on April 1 next year. The statements referred to "reductions of up to 40% on existing commodity rates on certain goods" and also (confusingly) to "Jet Age economy rates with reductions of up to 80%." Examples were given which would certainly lead any prospective air shipper to the belief that any reductions applied to large consignments of exotic and extraordinary products rather than to the odds and ends of goods which most people might suppose to be worth sending by air.

It is nice to know, for instance, that the new North Atlantic rate is 5s. per kg. (in the case of shipments of 45 kg. or more) for shoes (but not for boots?), agricultural machines and adding machines; that it is no more than 5s. 9d. per kg. for artificial flowers or sports goods; and only 6s. 6d. per kg. for pneumatic machinery (balloons?) and musical instruments.

But, as it happens, we don't want to send, right now, any of these commodities to the U.S.A.—nor foodstuffs, magazines, textiles, "certain" leather goods, radio, television, electrical household appliances, pottery, china, glassware, surgical and scientific equipment, optical goods, films, gramophone records, automobiles and spare parts. If, next April, we have the sudden idea of sending our three old trombones to Pittsburgh for Aunt Agatha's collection of vintage musical instruments, their combined weight will probably be found to be only 10 kg. Anyway, it is quite monstrously unfair that the rates for trombones (and basset-horns) should be higher than those for washing machines and telescopes.

The little list of North Atlantic all-freight carriers in this column last week (p. 593) was short by one. Sabena has now started a once-weekly service with DC-6As between Brussels and New York.

B.O.A.C. now uses two-way VHF (transmitting from the tower of Airways Terminal and controlled from the Dilke Street, Chelsea, freight depot) to keep in touch with its cargo pick-up vans in the central London area.

NEW TRAVELLERS.—Two new British transports which will be in service with B.E.A. in 1960 are seen here in the course of proving trials. In the upper picture is the Vickers Vanguard, undergoing tropical trials at Nairobi; and, below it, the Comet 4B on its first visit to Vnukovo Airport, Moscow.

Only the VANGUARD

paces the jets at much less than half the cost

ALL ROUND Europe, and on record flights in Canada, the Vickers Vanguard has been logging block times which have proved that on short and middle distance routes it can more than hold its own with the jets. It has, in zero wind, beaten current jet schedules on sectors as long as London-Rome (955 st. miles). It has flown London-Gander (2,365 st. miles) in 5 hours 30 minutes, and Toronto-Montreal (335 st. miles) in a record 58 minutes in zero wind.

Other Vanguard block times are:

LONDON-BRUSSELS
230 miles in 45 minutes (5 m.p.h. headwind).

LONDON-HAMBURG
470 miles in 73 minutes—a record (17 m.p.h. tailwind).

LONDON-PARIS
224 miles in 41 minutes (zero wind).

PRESTWICK-KEFLAVIK
920 miles in 2 hours 35 minutes (zero wind).

KEFLAVIK-MONTREAL
2,360 miles in 6 hours 2 minutes (30 m.p.h. head-wind).

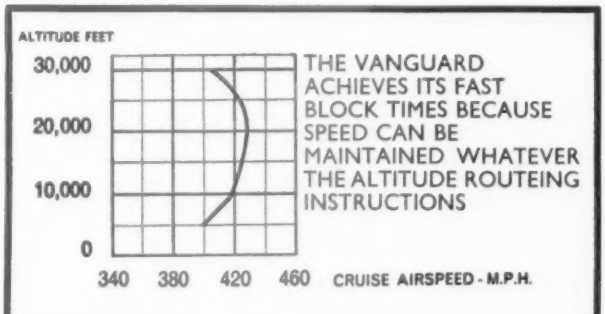
The Vanguard has achieved these block speeds at costs nearly one-third of those of comparable pure jet aircraft.

Recent U.S.A. figures show jet aircraft flight hour direct costs as 2.8 times greater than those of the Vanguard, and seat mile direct costs 2.6 times as great.

The Vickers Vanguard has, without doubt, the biggest profit potential ever offered to the airline industry — and it offers it at proved realistic competitive speeds.

The Economy Class cheap-fare capabilities of the Vanguard are at the forefront of the now established world movement for popular air travel. Only the Vickers Vanguard can bring these vast new markets to the Airlines on short and medium haul routes, at a substantial profit, and the Vanguard can do this with schedules as fast, if not faster, than any other aircraft.

Vanguard costs used in this comparison are to A.T.A. formula. Both the Viscount 745 and the Viscount 810 filed costs have been proved in practice to be substantially below such A.T.A. formula costs.



Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

● ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

AT 637

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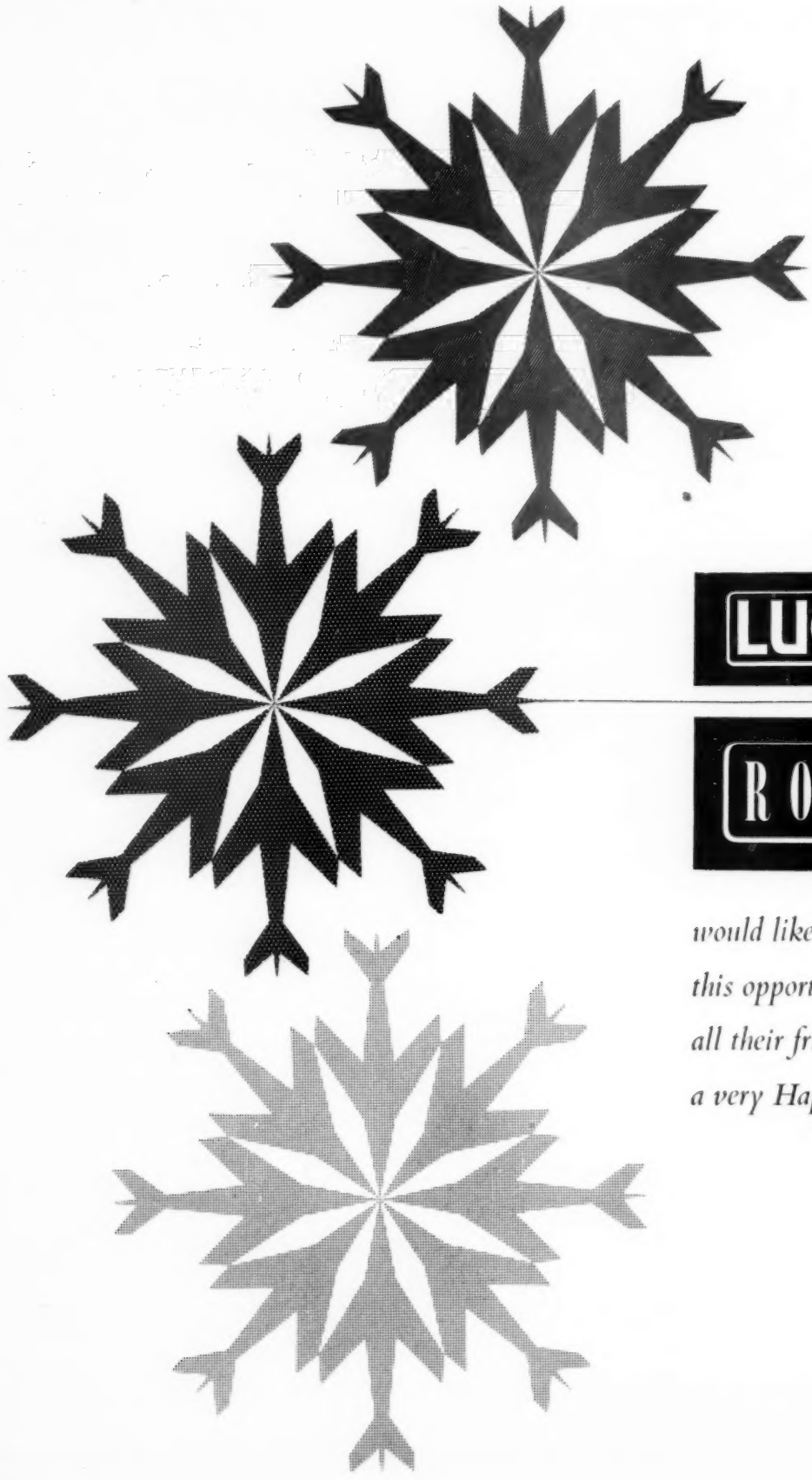


LUCAS

ROTAX

would like to take
this opportunity of wishing
all their friends
a very Happy Christmas.

Air Transport . . . .

Idlewild Development

EVENTUAL extension of Idlewild's long 13R/31L runway to 16,200 ft., and the building of a 3,400-ft. extension of runway 22R/4L out into Jamaica Bay are among the future developments planned for New York International Airport. Work on 22R/4L, which is the present instrument runway, will begin as soon as the parallel new instrument runway (22L/4R, 8,400 ft.) is opened to traffic in the next few weeks. In the first stage of this work, 600 ft. will be added to the northern end of the runway, where it is limited by the airport boundary, and 2,100 ft. will be built on at the southern end. Further extension into the Bay, to make the runway 12,000 ft. long, is envisaged.

Runway 13R/31L will be extended by 3,400 ft. at the eastern end, and a 1,600-ft. extension at the western end has been earmarked for future building to make the total length 16,200 ft. The idea of this very long runway is to permit take-offs to be started, in either direction, as far away as possible from surrounding built-up areas; no one has yet suggested that a runway of this length is actually needed by the jet aircraft so far ordered.

Idlewild's new instrument runway, 22L/4R, is to be one of the best equipped in the World, with the latest landing aids, lighting and high-speed turn-offs. It will be bi-directional, and used only for landings in IMC, with the parallel 22R/4L used for take-offs. It has two high-speed taxi exits in each direction, bisecting the runway at 30° and with a 1,800-ft. radius for aircraft speeds up to 60 knots.

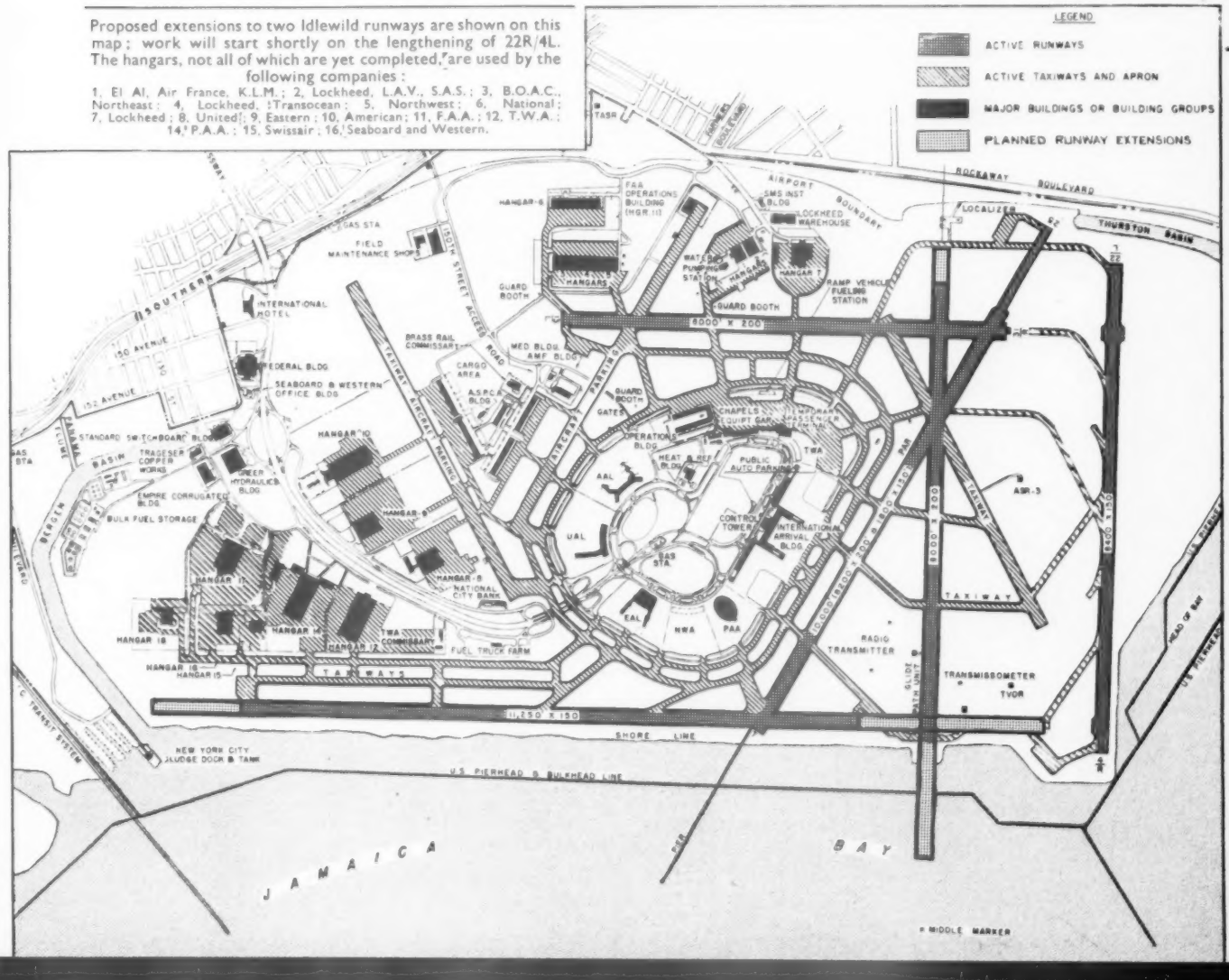
In addition to ILS at each end, the new runway has high-intensity centre-line approach lights extending 3,000 ft. from both ends, with condenser discharge lights in the centre of each of the 30 bars flashing in sequence to "point" down the runway. Runway lights are of the flush, narrow-gauge type, extending 3,000 ft. down the runway in two rows; each row has three lamps spaced over 7½ ft., and there is 60 ft. between the inner lamps of the two rows. Down the centre line, single flush lamps are spaced at 100 ft. Elevated runway-edge lights are also at 100 ft. intervals and are wired alternately to two independent power sources.

Progress with the unit terminals of the major U.S. domestic trunk lines in the Terminal City area at Idlewild was evident

Eastern Air Lines' unit terminal at Idlewild was formally opened on November 23. Its two fingers serve up to 24 aircraft positions.

Proposed extensions to two Idlewild runways are shown on this map; work will start shortly on the lengthening of 22R/4L. The hangars, not all of which are yet completed, are used by the following companies:

1, El Al; Air France; K.L.M.; 2, Lockheed, L.A.V., S.A.S.; 3, B.O.A.C., Northeast; 4, Lockheed, Transocean; 5, Northwest; 6, National; 7, Lockheed; 8, United; 9, Eastern; 10, American; 11, F.A.A.; 12, T.W.A.; 14, P.A.A.; 15, Swissair; 16, Seaboard and Western.



LUCAS

ROTAX

would like to take
this opportunity of wishing
all their friends
a very Happy Christmas.

Air Transport . . . .

Idlewild Development

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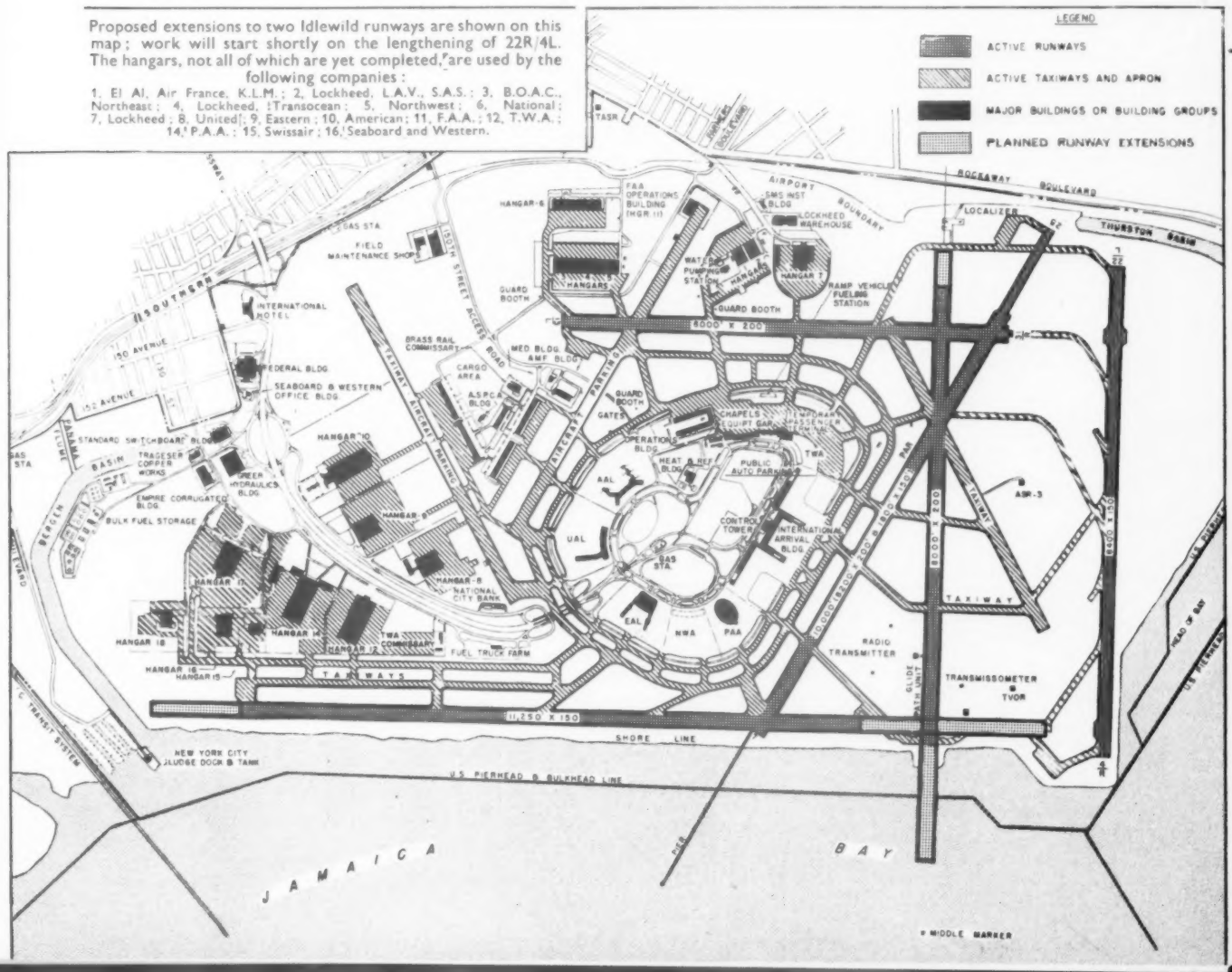


when THE AEROPLANE AND ASTRONAUTICS visited the airport last month. Two of these terminals, those of United Airlines and Eastern Air Lines, are now in regular use, and American Airlines' terminal will become operational on January 1, 1960. Pan American's unique "umbrella" terminal is already recognizable and will be complete next year, leaving only the T.W.A. building—not yet above ground level—to be finished in 1961. Completion of these unit terminals, to handle all domestic traffic and international departures of the appropriate operators, will free a large part of the old temporary passenger terminal, which now strikes one as being more dreary than London Airport North.

The airlines have been given almost complete freedom in the design of their unit terminals, which are completely self-contained and intended to spread the load of an anticipated 12 million passengers a year using the airport by 1965. First in use was United's, which is also one of the more conventional, comprising a two-floor, crescent-shaped block with a single "finger." Stands are provided for 13 DC-8s and four smaller aircraft, and two pivoting, telescopic, 100-ft.-long mechanical passageways known as "jetways" will be used to load passengers directly on to the aircraft.

A second finger is to be added to the United terminal later and will be used by Delta Air Lines, which will lease part of the terminal also.

Eastern Air Lines' unit is not unlike United's, with a three-floor main lobby and two fingers providing up to 24 aircraft positions. It is the largest of the Idlewild terminals, with a floor area of over 360,000 sq. ft. and has an ultimate capacity for the transit accommodation of about six million passengers a year.

American Airlines' building is one of the most eye-catching, thanks to the 320-ft.-long stained-glass window with its bright, abstract patterns. This window, 23 ft. deep, covers one face of the three-floor main building. Concourses at each end provide up to eight aircraft positions each, and each gate has its individual waiting lounge alongside. Enclosed "airbridges" will connect each gate position with the aircraft entrances.

Pan American's terminal dispenses with fingers in favour of a single central lounge around which six aircraft can be parked simultaneously under the huge cantilevered concrete roof. The whole of the main concourse will be glass-walled, entered from either of two levels through a 90-ft. "air curtain" which makes doors redundant.

Trans World Airlines' terminal is scarcely less revolutionary than Pan Am's, with its "soaring central structure, suggesting the flight of a giant bird" (says the publicity blurb). This structure actually is a concrete shell made up of four interacting vaults, covering the entire concourse. From it will lead two fingers, with protected access to and from 10 aircraft.

In addition to these five unit terminals, each with its own shops and restaurants, space has been allocated to Northwest Airlines, but work has yet to start on this building. Other U.S. operators using Idlewild will continue to use the temporary terminal until new accommodation can be provided—probably on the same site. All foreign-flag operators, with the exception of Avianca and T.C.A., are, of course, already located in the wing buildings flanking the International Arrival Building.—F.G.S.

South American Commentary

What's a Little Discount Between Friends?

THE biggest news to strike South America last month was the Great Discount Row. How it all started is a little obscure. Of course, it is no secret to anyone that, despite IATA rules, any good travel agency could obtain for its customers discounts from the various airlines—a process which practically amounted to bidding for the customer, which IATA fears above everything else.

It seems, however, that Panair do Brasil sparked the whole row off by starting to give bigger discounts than anyone else, a fact which apparently roused the ire of the other airlines operating in and out of the terminus of South America, Buenos Aires. They immediately embarked on a frantic orgy of masochistic ticket-slashing which left customers joyously yiping for more. As airline tickets (a) have a one-year validity and (b) are refunded 100% in the event of cancellation, practically everyone who wished to travel to Europe, or who at any time remotely entertained the intention of travelling to Europe, galumphed to the nearest airline or ticket agency and thus saved himself a cool $500—no trifling sum in these austerized times.

Ticket sales suddenly went up at a frantic pace and soon were breaking all records, not only in the matter of the number of seats sold, but also of the actual cash volume turned over, even though the tickets were going for half the usual price. People were even fighting each other over queues in the offices of the more important lines. It was all very jolly, but where would it stop?

After a few days the Argentine Dirección Nacional de Aviación Civil stepped in, sternly warning IATA infractors that they must adhere strictly to the Association's rules. Why the D.N.A.C. should have been so preoccupied about IATA is a moot point, although one suspects, perhaps uncharitably, that the D.N.A.C. were to a certain extent thinking in terms of the Argentine Government's Aerolíneas Argentinas, an airline which has too many of its own little ways of losing money to be able to embark on a high, wide and handsome plan of Bankruptcy for You, Too. A day or two later, Aerolíneas publicly tut-tutted the whole affair, although they were by no means guilt-free in the Good Old Days when the lines, cautiously and with furtive looks hither and thither, would slip the customer a 10% knock-off ("because you're a personal friend of our office-boy's third cousin").

Another theory advanced is that the whole question started because Aerolíneas and Panair do Brasil objected, in the Honolulu IATA gabfest, to the suggestion of establishing on the South American run an Economy Class which would be 30% cheaper than the present tourist category.

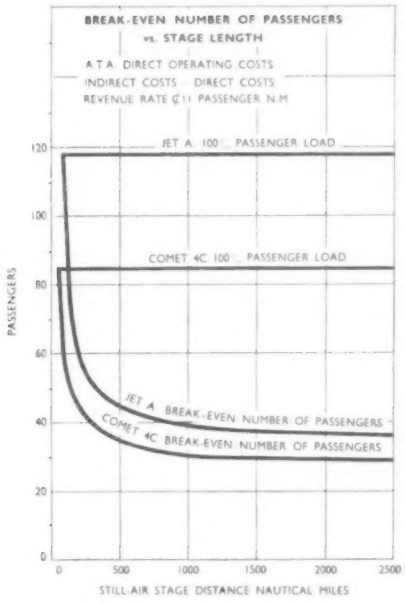
The Say It With Discounts movement certainly hasn't been stymied by the D.N.A.C., however. While we are unable to say if any Top Secret rebates are being given in Buenos Aires, we do know that all the B.A. agencies are freely touting 40-45% rebates on tickets from Montevideo to points north—Monte being a skip and a hop across 60 miles of River Plate.

So the stunt is to buy a regular cabotage ticket to Montevideo—price a whopping $5—and then proceed to save up to $500 from Monte to London, Paris, or where will you. The Uruguayans, not having an overseas carrier of their own, couldn't care less whether or not the airlines kowtow to the International Air Transport Association.

Interviewed by a Buenos Aires paper, the different companies all said, "Who? Us?" when the discount question was raised. S.A.S. admitted obliquely that they were discounting, so did Air France; Panair do Brasil denied the whole issue and Aerolíneas Argentinas went so far as to Express Grave Concern. The B.O.A.C. representative (B.O.A.C. are to reopen services southwards in January) said he couldn't say anything until he received instructions from London. The airlines later embarked on a general meeting in Paris to see what could be done [and appear to have come to terms with IATA resolutions.—ED.]. However, the whole thing shows up the gossamer nature of IATA's foundations, at least when the carriers think they're far away with nobody looking.

While the jet age is still getting under way, ponderously but surely, with the Brazilian Varig taking delivery recently of their first Caravelle, the World-famed Aerolíneas-Panagra bout is still raging, with each thinking of fresh ways of doing in the opponent on the profitable Buenos Aires-New York run. Panagra scored a useful victory (whether they had a hand in it or not) when the Brazilian authorities, mumbling something about nasty jets which mucked up their nice airfields, cancelled the Aerolíneas permit to fly Comets to and from Rio de Janeiro. Pan Am received authorization to make one flight weekly to New York per 707, but recently there was another dispute when Pan Am, apparently, decided to schedule another flight all by themselves, not bothering to acquire Government authorization first. The result was that passengers had to get off at Asunción and be ferried B.A.-wards on a Panair do Brasil piston-engined DC-7C. Now the Americans say they will run the second weekly frequency to Montevideo, because of the "delay" in the granting of the required permit by the Argentine Government.

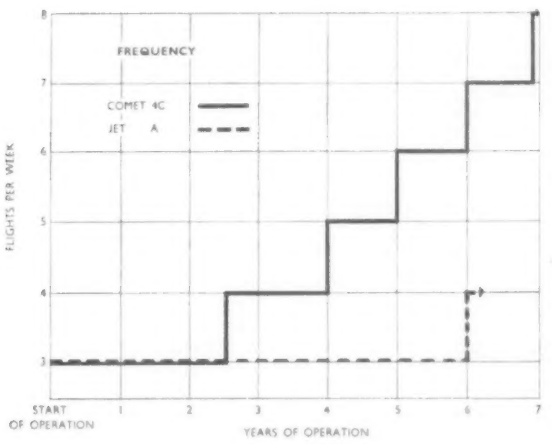
Politically speaking, Uruguay has often been referred to as the "Switzerland of America" due to a strong democratic tradition and, lately, the adoption of a collegiate system of Government similar to that used in Switzerland. This may or may not have influenced the signing of a pact between them, for unlimited reciprocity, Fifth Freedoms galore, and what not. Uruguay does not, at present, as we have said, have an international carrier, nor are there any rumours of the semi-State PLUNA wishing to extend itself beyond the "regional" scheme of things. Switzerland have their Swissair. However, when Swiss meets Swiss, and all that—what?—FEDERICO B. KIRBUS.


BREAK-EVEN NUMBER OF PASSENGERS
vs. STAGE LENGTH
A.T.A. DIRECT OPERATING COSTS
INDIRECT COSTS = DIRECT COSTS
REVENUE RATE 2·11 PASSENGER N.M.
JET A 100% PASSENGER LOAD
COMET 4C 100% PASSENGER LOAD
JET A BREAK-EVEN NUMBER OF PASSENGERS
COMET 4C BREAK-EVEN NUMBER OF PASSENGERS
PASSENGERS
STILL-AIR STAGE DISTANCE NAUTICAL MILES

COMET
makes more profit

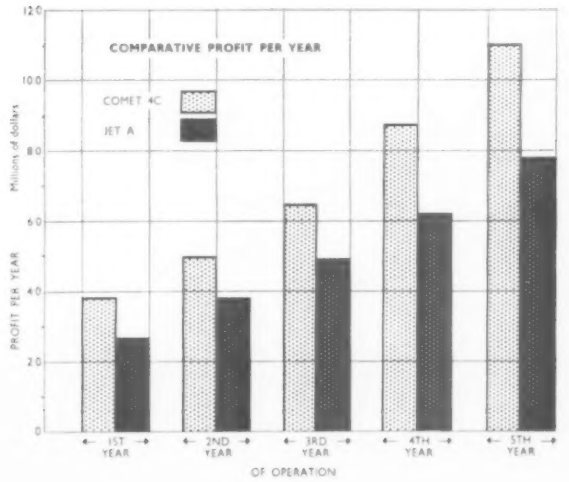
The Comet makes more money from the start because it pays with fewer passengers. Compare it with "Jet A", its nearest rival in medium-haul operations.

Take a typical route, Europe-Tokyo, with an average stage of 1,500 nautical miles, and assume initially 150 passengers a week, a basic traffic growth of 10 per cent per annum, in a competitive situation requiring three-weekly frequency.



The Comet can economically increase frequency, as traffic grows, after 2½ years (and then at decreasing intervals)—its nearest rival not for 6 years.

Frequency itself accelerates traffic growth, attracting passengers from other airlines.



From the start and through every year the Comet makes more profit—even taking into account the purchase of an additional aircraft as the need arises. A still larger jet, despite lower seat-mile cost, would be even less profitable.

For routes of moderate traffic density the

DE HAVILLAND

COMET

(Rolls-Royce Avon Jet Engines)

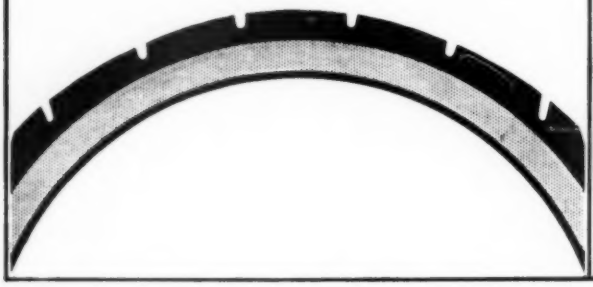
is supreme

INCREASED TYRE LIFE FOR JET AIRCRAFT

GOODYEAR REINFORCED TREAD AIRCRAFT TYRES

ONE THIRD MORE SKID-DEPTH

Conventional high-speed tyre



Goodyear Reinforced Tread tyre

(With extra skid-depth)

SPECIALLY developed for landing speeds over 160 m.p.h., Goodyear Reinforced Tread Aircraft tyres have additional layers of fabric moulded into the actual tread rubber. This permits safe retention of a greater skid-depth than is possible with conventional high-speed tyres. Up to one third more usable tread thickness means more landings per tyre—with consequent reduction of replacement and maintenance costs. The reinforcement—backed by the strength of the Goodyear carcass—also gives improved protection against stone bruising.

The Goodyear Tyre & Rubber Co. (G.B.) Ltd., Aviation Products Division: 8-9 Salop Street, Wolverhampton. Tel.: Wolverhampton 27727. Airline Sales & Service, Viscount Way, London Airport, Hounslow, Middx. Tel: SKYport 1922.

GOODYEAR AVIATION DIVISION

SERVING AVIATION THE WORLD OVER

Air Transport . . . .

Commercial Aircraft Addenda

THE many readers who keep our annual Commercial Aircraft Number as a permanent reference source, may care to note the following corrections and additions to the October 16 issue.

Design cruising speed of the D.H.121 (page 336) should read 0.875/360k. Normal accommodation of the Avro 748 (page 338), at 36-in. seat pitch, is 40. R.C.A.F. orders for the Canadair CL-44D (page 347) total 12, not 10 as shown. On the payload-range curve for the Fokker F-27 (page 356) the direct operating costs assume a 15 m.p.h. headwind and I.S.A.+10°C. The price of Fairchild F-27s has now increased to $720,000 with Dart 511s and $780,000 with Dart 528s, at the new gross weight and with standard interiors.

Hatfield Control

AN automatic fixer system and a 50-kW. 50-cm. radar have been installed at de Havilland's airfield at Hatfield. Primarily intended for plotting company or visiting aircraft, the radar can also be used to pass positional information to Luton or Radlett.

Operated in conjunction with the radar, a Marconi type S232, the automatic fixer system can be employed as an aid to identify aircraft shown on the PPI display. The fixer uses two Marconi type AD200 VHF finders, one of which is sited at Hatfield and the other at BeJells End, near Chelmsford. The latter is remotely operated from the Hatfield tower via a 15-watt VHF radio link.

The aircraft bearing information from the two VHF/DF units is fed into the fixer console and shown on a 17-in. CRT display containing a superimposed translucent map of the area. Each bearing is displayed in the normal way as a line originating from its particular direction finder and the resulting intersection, i.e. the aircraft position, can be used to identify positively an echo on the radar PPI, without the need for the controller to request the pilot to make a radar identification turn.

OVERSEAS ARGONAUT.—Five 65-seat Argonauts have now been purchased from B.O.A.C. by Overseas Aviation (C.I) Ltd. Formed in January 1958, this company also has three Vikings and in the last year has flown over 78 million passenger miles.

Ruling Out Noise

NEW airport traffic pattern rules have been proposed by the Federal Aviation Agency for Los Angeles International Airport in an effort to reduce the noise of jet aircraft over surrounding residential districts. This is the first attempt by the F.A.A. to spell out anti-noise regulations, but it is at present no more than a draft Special Civil Air Regulation, on which comments are invited.

The noise problem at Los Angeles has recently become acute, with more than 80 scheduled civil jet movements a day in addition to many military and manufacturers' test flights. If the F.A.A. proposal is put into effect, the airspace up to 2,000 ft. in a five-mile radius from the centre of the airport would be designated as the traffic pattern area, in which all civil and military aircraft would have to conform to the rules. Under these rules, aircraft would have to take-off to the west (i.e., towards the open Pacific) in calm wind conditions, and between 10 p.m. and 7 a.m. jet aircraft would take off in this direction provided the downwind component was not more than 10 knots. (Pilots would retain final authority in selecting runways if they believed the aircraft's safety was involved.)

Aircraft taking off would be required to climb straight ahead to 1,500 ft., and those landing at the airport to enter the traffic pattern above 1,500 ft. (weather permitting). Inbound jets would descend at a minimum angle of 3° on final approach when landing towards the west (over the residential areas). Aircraft not intending to land at Los Angeles International would be prohibited from entering the traffic pattern.

How effective these measures would be in combating the noise nuisance is difficult to guess. The proposal is most interesting as an attempt to place noise reduction measures on a legal basis and is clearly intended to alleviate the problem as much as possible without penalizing the operators. If it is successful, similar traffic patterns are likely to be established at other major airports, including New York.

The position at New York International Airport, Idlewild, is less than satisfactory at the present time, with the Port of New York Authority and the Air Transport Association in open disagreement. We talked in New York last month to spokesmen for both parties and it quickly became clear that the airport Authority can do virtually nothing to enforce the noise-abatement regulations it has laid down (only for take-offs) and which more than one operator openly flouts. In the eyes (or the ears?) of the Authority, a take-off is "in violation" if the noise level recorded on the ground at a point approximately three miles from the start of take-off is in excess of 112 pndb (perceived noise decibel level). One of the most critical areas as the Howard Beach community, off the north-west end of the long 31L runway, and the Authority has recently installed automatic equipment at this point to record all aircraft noise.

This equipment is linked with the sound control room in the airport tower, and is activated automatically by any noise above 97 pndb. When other runways are used, a mobile team is positioned to make recordings which are brought in for subsequent analysis.

Idlewild now has at least 50 jet movements in a daily total of 700. In the period from October 27 to November 18, 127 out of 799 jet take-offs were in violation; the great majority of these were Boeing 707s, with a few DC-8s and, very occasionally, a Comet. Violations, incidentally, have ranged as high as 134-135 pndb which in terms of noys is some four times the 112 pndb level.

The sound-crew observers at Idlewild have now made an arrangement with the airlines on the spot whereby the latter provide information, an hour before take-off, on weight and runway to be used. Taking into account wind and temperature, the observers can then calculate whether a flight will be in violation before it leaves the ramp. This information is given to the airlines before the take-off—but without apparent results.

In fact, a great part of the Authority's work on noise must be regarded as a community relations effort, designed to give the impression that something is being done to alleviate the nuisance. The strength of community feeling was shown recently when the president of Queens Borough wrote to President Eisenhower on the subject.

The Air Transport Association, representing all the major U.S. airlines, approaches the problem from a naturally different viewpoint. It believes that no hard line can be drawn between acceptable and intolerable noise levels and that the only solution is to work out take-off and landing procedures to reduce noise to the minimum compatible with safe operation. It firmly resists any moves to close specific runways to jets, or to limit the hours of operation, on the grounds that these would inhibit the design functions of both aircraft and airport. Similarly, any regulation which would require payload to be off-loaded, or an en-route fuelling stop to be made, would be regarded by the A.T.A. as "degrading" the aeroplane.

In an attempt to reconcile the different viewpoints the A.T.A. has set up a new study group, including representatives of the F.A.A., ALPA (Air Line Pilots' Association) and the manufacturers. This group will start work on January 1 and it is hoped that its report, by the middle of the year, will provide a basis for a less emotional approach to the noise problem.

Meantime, only one thing is certain: however much the nuisance of individual take-offs and landings can be reduced, the frequency of the nuisance will increase, for local residents, with distressing rapidity.—F.G.S.

Flying the Pi

SWITZERLAND is a natural breeding ground for STOL aeroplanes, and such a type was the first product of the Pilatus Aircraft Works after its formation in December, 1939. Since then, the company has been responsible for the supply of most *ab initio* trainers to the Swiss Air Force, including the currently produced Pilatus P.3. Its interest in STOL aircraft has continued, however, and has resulted in the recent development of the ultra-utility PC-6 Porter.

The initial presentation of the prototype at this year's Paris Show left no doubt as to the degree of totality achieved in sacrificing appearance to efficiency. The Porter looks the sort of aeroplane you saw off in lengths rather than build. But as I have found in other workhorse aeroplanes, such as the Auster Agricola, appearance is not always a reliable guide to handling and performance. I was glad of the Porter's tractability and pleasant flying qualities when I flew it, in appalling weather, during its recent visit to this country.

The demonstrator, HB-FAO, was the second of the five pre-production Porters, the first of which made its initial flight on May 4 this year. The well-known Swiss Alpine pilot, Hermann Geiger, has already taken delivery of one of the first four Porters, which are powered by the geared and supercharged Lycoming GSO-480 engine, developing 340 b.h.p. for take-off. The fifth aircraft is to have the normally aspirated 275 b.h.p. Lycoming GO-480-B, which is an alternative powerplant for low-altitude operations from all except the shortest strips. Both the initial and operating costs of this version are lower, and the 44 lb. reduction in engine weight can be converted to useful load.

With the larger engine, driving a three-bladed Hartzell constant-speed metal airscrew, the Porter is now cleared to carry seven persons and sufficient fuel for 1½ hr. safe endurance, with STOL performance. This it achieves, without design complication, by a low wing-loading, useful power margin and generous double-slotted flaps on a high-lift wing.

Recourse is now not even made to drooping ailerons to augment low-speed lift, these having been abandoned because of the accompanying increase in stick loads. Single-slotted units are now employed. The control surfaces, like the rest of the airframe, are of all-metal stressed-skin construction, with the maximum angularity for simple fabrication. The cabin section of the fuselage is a rectangular box, with an enormous cut-out for the double doors, which may be removed for flight. The rear fuselage is a tapered box, terminating in the sternpost-mounted long-stroke tailwheel.

Despite its apparently elementary contours, the centre fuselage incorporates much design skill to maintain its strength factors with so little structure. Apart from the 5-ft. wide starboard door aperture, and the cut-out for the frameless moulded cockpit canopy, an equal width window on the port side is uninterrupted by structural members, while in the cabin floor is a 2 ft. by 3 ft. hatch which may be opened for supply dropping or photography. Airframe factors are +3.8 and −1.7*g*.

For its visit, the Porter was furnished with its normal complement of six quickly removable lightweight seats in the cabin, which extends 7 ft. 6½ in. aft from the front seat-backs. Width is 3 ft. 9½ in., and the seats may be replaced by any of the usual utility loads, stretchers and so on. Maximum short-range payload is about half a ton.

Before flying the Porter, I sat in the cabin while an Army Air Corps pilot tried his hand, watched by Pilatus test pilot, Herr R. Böhm, in the right-hand seat. The Swiss pilot's rôle was necessarily confined to advice, since the Porter is not fitted with dual control. His confidence, however, despite the marginal weather, spoke well of the aircraft's handling.

Apart from some back-seat driving I was able to sample the general comfort and moderate noise level of the cabin. The Porter uses a form of augmented exhaust ejection for low-speed engine cooling, via a single large-diameter stack beneath the port side of the fuselage. There it keeps exhaust fumes well clear of the ventral hatch or entry doors, and also takes a lot of noise aft of the cabin. This is still quieter at the cockpit end, although the GSO-480 always did sound rather busy in a gear-grinding sort of way.

When I came to sit in the left-hand seat via the gate-hinged back of the co-pilot's throne, I found the forward view much less restricted than I had imagined. It is actually better than in most high-winged STOL aircraft, with only a thin central windscreen frame to obstruct all-round visibility. The gently sloping cowling was not obtrusive, and although the front screen suffered the usual obliteration in heavy rain, vision through the curved side pieces remained sufficiently good for the absence of clear-view panels not to be critical.

The inside also remained mist-free, and this was a further tribute to the wonderful heating system which provided a very civilized atmosphere in the Porter. It was in marked contrast to the half-gale outside at Thruxton, where the aircraft was based for its demonstrations. It was also flown from Middle Wallop, the grass surface of which was perhaps slightly more representative for an aeroplane of its type. For very muddy surfaces, the Porter may be fitted with enormously oversized Goodyear low-pressure tyres.

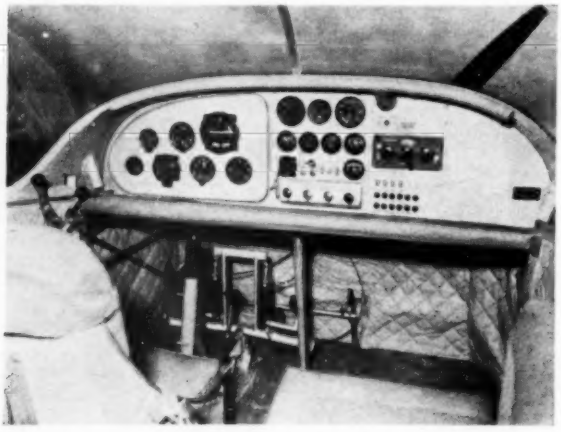
Like the rest of the aeroplane, the instrument and control layout could not be simpler. On the left of the wide panel, which has a large and useful shelf in front of it, is a group of basic flight instruments, plus a Continental combined horizon and turn-and-slip. Engine instruments are in the centre with individual gauges for the two 28.5 Imp. gal. wing tanks. These are of the integral type and are to be increased in total capacity to 88 gal. in later aircraft for a 50% increase in range. A Becker 24-channel radio and sundry switches complete the array, leaving a generous area of space on the right of the cockpit.

This is very roomy and comfortable and all the controls come readily to hand. The short stick is convenient to use, and the rudder-bar gantry, with its separate toe-brake pedals, is adjustable for leg length. On the port cockpit wall is a selector for tailwheel lock, castor or steer, but this was left in the coupled position throughout. Next to it are the fuel cock and rudder-trim wheel, but the latter is not really necessary either and may be deleted.

Longitudinal trim is via a small crank-handle on the cockpit ceiling, concentric with a larger crank for the flaps, and controlling tailplane incidence. I dislike all trim controls which are not mounted in their logical plane of movement, and in the Porter I found it necessary to watch the adjacent indicator strip to avoid trimming in the incorrect sense. The tailplane trimmer is low-geared and did not seem particularly sensitive, but the changes of trim were never pronounced during my short flight.

Because of the weather, plus approaching darkness, this was far briefer than normal on such occasions, and a second attempt at a later date was frustrated by even worse conditions. It was therefore not possible to do more than the most general of handling, with no stalls and only a couple of take-offs and landings, and to these my impressions will have to be confined.

Taxi-ing the Porter, despite the very strong wind, was simple with the aid of the steerable tailwheel, and very little brake was required. Ground stability with the wide-track undercarriage was good, and a pleasant ride was given by the



The Porter cockpit employs a very simple layout and a single set of controls. Above the panel can be seen the large duct for windscreen demisting.

latus Porter

by John Fricker

11½ ft./sec. oil-damped steel-sprung undercarriage. The main-wheel legs are far enough forward for the disc-brakes to be used quite fiercely without raising the tail. This was the case even with our C.G. position of about 20% (four people and roughly half fuel). Normal C.G. range is 11-33%.

For this load, about 2½ divisions of aft trim was selected for take-off, together with 30 degrees of flap. As usual in STOL aeroplanes, take-off flap is not far off the maximum setting, which in the Porter is 44 degrees. Flap is applied by pulling down the crank-handle to clear its ratchet and turning it while watching a small white rod protruding from the inner wing leading-edge.

Slightly illogically, this rod disappears into the wing as flap is lowered and has red lines at intervals to indicate 10 degree increments of extension. The take-off setting is the penultimate mark.

At Thruxton, the boisterous wind was slightly across the runway from port, accentuating the natural bias of the Pilatus in that direction on take-off. While opening up the throttle cautiously through its long travel to the gated take-off power of 1.64 Ata and 3,400 r.p.m., and feeling my way with rudder to keep straight, we found ourselves airborne at about 60 km./hr. (37.2 m.p.h.) I.A.S., without having moved the stick from its neutral position.

There was plenty of rudder in hand (or foot), and the Porter was off the ground in less than 100 yd., well before full power was achieved. The climb-away, at about 100 km./hr. (62 m.p.h.) was very steep, and was accompanied by a slight buffet from the flap downwash over the tailplane. The V.S.I. indicated about 5 m./sec., which is not much less than 1,000 ft./min., and the power margin is very evident in the express lift-like ascent. The supercharged Porter has a service ceiling of 24,000 ft. or so, at max. weight, and has been taken to more than 31,000 ft. when flying light.

After a slight feeling of surprise at becoming airborne so rapidly, I was relieved to discover that the Porter seemed to disregard much of the turbulence, as I wound up the flaps with little accompanying sink or change of trim. Power was reduced to the max. continuous setting of 1.3 Ata and 3,000 r.p.m. and then almost immediately to 1.2 Ata and 2,500 r.p.m. to avoid entering cloud.

The slight nose-down pitch accompanying flap retraction served to put us in our cruising attitude, and with this setting for about 60% power, we indicated 175 km./hr. (nearly 109 m.p.h.). At the optimum altitude of about 10,000 ft., this power returns 195 km./hr. (121 m.p.h.) T.A.S., for a consumption of only 12.3 Imp. gal./hr. in automatic weak mixture.

Unlike many aircraft of its type, the Porter appears to have very moderate control forces in flight, with pleasant harmonization. The ailerons, in particular, are precise and effective, although the very positive lateral stability can be felt during their application, and a little rudder helps improve the rate of roll. The rudder is fairly light and the elevators just about right.

Although it did not seem sensible to explore the stalling performance of the Porter at about 1,000 ft., speed was reduced below the flap limit of 135 km./hr. (84 m.p.h.), indicated by a white line on the A.S.I., and landing flap extended. At 80 km./hr. (50 m.p.h.), which is the lower limit of the white segment, lateral response of the Porter was still good, and there was no noise from the stall warning horn in turning quite steeply from bank to bank.

The stall, with flaps down, has been observed to be a straight sink at about 70 km./hr. (42.4 m.p.h.). Opening up to climbing power after trimming from the flaps-down glide resulted in a briskish nose-up tendency which could be held comfortably with one hand while re-setting the tailplane with the other.

With correct tailplane trimming, there seemed ample elevator power in the Porter for an optimum STOL landing from an engine-off glide, but at Thruxton it was a matter of feeling the aircraft back on the ground in the increasingly heavy rain. One slight difficulty in these circumstances is that the engine has a resonance period at about 2,000 r.p.m. which prohibits the use of power in that range.

Coupled with the formidable wind, this made the approach slightly erratic, but fortunately the excellent stability of the Porter did much to counteract these disadvantages. From a final approach speed of 95 km./hr. (59 m.p.h.), with full 44 degrees of flap, the elevator is pleasantly responsive for a smooth three-pointer, which was achieved at around 43 m.p.h. with nearly full aft stick movement and an intermittent bleat of stall warning. Brakes can be applied almost immediately for an absurdly short run. Apart from its approach angle, the Porter is very reminiscent of the old Leopard Moth with its sweet and well-damped landing and it has also been described, with some justification, as a big Auster.

It is no more difficult fly, and very little more complicated. The first prototype has completed some 250 hours without any snags. Twenty production aircraft are being laid down, and offer excellent economy at a factory price of about £13,000, without radio. Cost per flying hour—excluding pilot's salary, is computed as £10 12s. for 500 hr. per year. The Porter has operated successfully on skis, and a floatplane version is under consideration.

Leading Particulars

DIMENSIONS.—Span, 49 ft. 10 in.; length, 33 ft. 6 in.; height, 10 ft. 5 in.; wing area, 306.8 sq. ft.

WEIGHTS (275 b.h.p. version in brackets).—Equipped, 2,420 lb. (2,376 lb.); five passengers plus pilot, 990 lb.; baggage, 110 lb. (154 lb.); oil, 28.6 lb.; fuel (57.2 Imp. gal.), 411.4 lb.; useful load, 1,540 lb. (1,584 lb.) max. gross, 3,960 lb.

PERFORMANCE (275 b.h.p. version in brackets).—Never-exceed speed, 186 m.p.h.; cruising speed, 125 m.p.h.; initial climb, 1,140 ft./min. (870 ft./min.); service ceiling, 23,950 ft. (13,780 ft.); take-off run to 50 ft. (at 2,000 ft.), 760 ft.; landing run from 50 ft. (at 2,000 ft.), 650 ft.; range, with 935 lb. payload, 500 miles; endurance, over 4 hours.

The Fighting Services

Malayan Honours

IN the *London Gazette* for December 8 was a list of awards to R.A.F. and Commonwealth Air Force personnel in recognition of distinguished service in Malaya.

The D.F.C. is awarded to Flt. Lt. D. Geddes, Flt. Lt. P. K. Wooldridge and Flg. Off. J. A. Boardman. Sgt. P. J. Cunningham has been awarded the D.F.M. and Flt. Sgt. K. E. B. Dally receives the B.E.M. Ten officers and other ranks, Wg. Cdr. R. H. Blackmore, Flt. Lt. M. L. Cann, Flt. Lt. K. W. Claydon, Flt. Lt. T. P. Meyer, Flg. Off. P. H. Putland, M. Plt. R. P. F. Hill, Acting Sgt. L. R. Belcher, Acting Sgt. L. S. Henry, Cpl. M. Fitzcharles and Cpl. Tech. E. F. McPhillips, have been mentioned in despatches.

Australian Defence

A NUMBER of major Australian defence issues, including the previously recorded decision to order the Bristol/Ferranti Bloodhound surface-to-air missile system and the disbandment of the Royal Australian Navy's Air Arm after 1963, have been announced by the Minister for Defence, Mr. Townley.

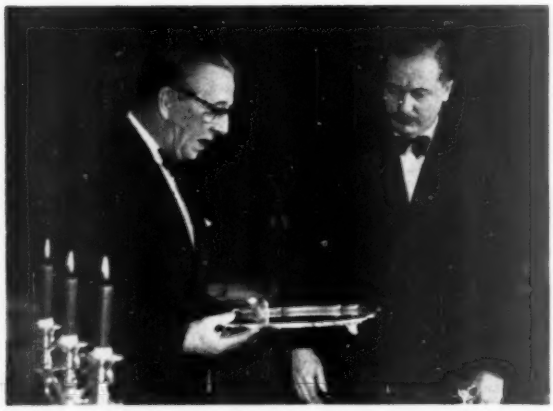
The Commonwealth's National Service training scheme is to be suspended on June 30, 1960, and the Army is to be reorganized into what is to be known as a Pentropic Division of five infantry battle groups. This new structure is designed primarily for operations in tropical areas with the emphasis on mobility and air transport.

For this work the R.A.A.F. now has its 12 Lockheed C-130A Hercules transports in addition to its older Douglas C-46 Dakotas and two V.I.P. Convair 440 Metropolitans. Scheduled Hercules freight services modelled on R.A.F. Transport Command lines were started earlier this year and are replacing the previous Dakota courier services operated by the R.A.A.F. These include flights through all the major R.A.A.F. bases on the Australian east coast and services from Richmond, N.S.W., through Victoria and South Australia to Pearce, West Australia, from Laverton up the east coast and through to Darwin, and from Richmond through Darwin to Butterworth, Malaya.

The Australian Government is at present examining a number of British and American bombers, but has not yet found a suitable aircraft to replace the G.A.F. Canberra B.20s operated by the three R.A.A.F. tactical-bomber squadrons. A number of fighters are also being considered for the R.A.A.F. to replace its three squadrons of Commonwealth CA-27 Sabres although no particular types have yet been officially named.

New maritime reconnaissance aircraft are to be purchased for the R.A.A.F., which is at present operating two squadrons of G.A.F. Lincolns and Lockheed P2V-5 Neptunes. A helicopter force is also to be established and the R.A.A.F. Sabre Wing at Butterworth is to be equipped with Sidewinder AAMs in the near future. A Sidewinder recently destroyed a Jindivik during trials over the Woomera rocket range.

The decision to wind up the operations of the R.A.N. Fleet Air Arm in 1963 has been made in light of the future need for new equipment. Within three years the existing aircraft—D.H. Sea Venom FAW.53s and Fairey Gannet AS.4s—operating from the carrier "Melbourne" will be obsolete; aircraft to replace them would require a more modern carrier. Although H.M.A.S. "Melbourne," formerly H.M.S. "Majestic," has a semi-angled deck, steam catapults and the mirror landing aid, she is not large enough for the latest carrier types now coming into service.



RADAR TROPHY.—A silver waiter bearing an engraving of the head of the Sting-Ray target-tracking and illuminating radar has been presented to the Officers' Mess, R.A.F. North Coates, by the Military Radar Group, A.E.I. Electronic Apparatus Division. The presentation was made on behalf of A.E.I. by Mr. V. M. Roberts, O.B.E. (left), and the gift was received by Wg. Cdr. H. L. Derwent, A.F.C.

Gift and Gifted

A PAINTING entitled "Thanks Again for Everything," by John Yale, depicting the last fly-past of two Spitfires in 1959, was accepted on behalf of Fighter Command by Air Vice-Marshal H. J. Maguire, A.O.C., 13 Group, at an exhibition of the artist's work which he opened on December 8.

Introducing the Air Vice-Marshal, Sqn. Ldr. Peter Latham, C.O. of 111 Squadron, paid tribute to the work and popularity of the artist, who had spent some days with the Squadron at Wattisham where many of the subjects were painted.

Mr. Yale is a young Canadian member of the Society of Aviation Artists and it is a pity that his exhibition, at the R.B.A. Galleries, Suffolk Street, S.W.1, closed on December 17.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. D. T. Witt, D.S.O., D.F.C., D.F.M., to the Department of the Chief of the Air Staff; Gp. Capt. D. C. Stapleton, C.B.E., D.F.C., A.F.C., and Wg. Cdr. J. M. Howard to the Department of the Air Member for Supply and Organization.

Bomber Command: Wg. Cdr. D. H. Sutton to R.A.F. Finningley to command No. 18 Squadron.

Fighter Command: Gp. Capt. D. G. Smallwood, D.S.O., M.B.E., D.F.C., to R.A.F. North Coates to command; Wg. Cdr. G. B. Masters to Headquarters to command the Control and Reporting Examining Team; Wg. Cdr. S. V. Vaizey to Headquarters, No. 11 Group, as Chief Signals Officer.

Coastal Command: Wg. Cdr. A. S. Baker, O.B.E., D.F.C., to R.A.F. North Front, Gibraltar, to command, with acting rank of Gp. Capt.; Wg. Cdr. S. L. Swain to Headquarters as Senior Equipment Staff Officer.

Flying Training Command: Wg. Cdr. T. D. Sanderson, A.F.C., to the R.A.F. Flying College, Manby, as Syndicate Leader.

Technical Training Command: Wg. Cdr. J. E. S. Salter to No. 3 Radio School, Compton Bassett, to command the Administrative Wing.

Maintenance Command: Wg. Cdr. E. G. Ambridge to Headquarters No. 41 Group, for equipment duties; Sq. Ldr. W. M. Smedley to the R.A.F. Staff College, Andover, for directing staff duties, with acting rank of Wg. Cdr.

ASSISTED.—An Australian Dakota has been fitted with JATO bottles as well as retractable skis for operation with the R.A.A.F. Antarctic Flight; it will be used for photographic as well as transport work. The extra 1,000 lb. of thrust provided reduces the transport's take-off run to 100 yd.

Progress in Nuclear-powered Aircraft

—*a Bibliographical Survey*

by J. Burkett*

EARLY this year, it was reported in *Aviation Week* that Russia had been flight-testing a nuclear-powered delta-wing bomber, said to be powered by two direct-air nuclear powerplants housed in the wings, with supplementary power from two conventional wing-tip turbojets. Whilst there is no direct evidence to support this claim, the many articles that have been written on the subject by Soviet scientists since 1955, together with the success of recent space projects, lead one to consider that it could be possible.

In America, the news met with scepticism from some quarters. Its main effect, however, was severe criticism of the Eisenhower Administration by Democratic members of the Joint Congressional Committee on Atomic Energy for having spent nearly 1,000 million dollars on the development of an atomic aircraft without any promise of a prospective test flight date. The Democrats wanted the U.S. to be the first to get a nuclear-powered aircraft into the air, regardless of utility, for reasons of prestige. Soon afterwards, Lt.-Gen. Wilson, the American Deputy Chief of Staff for Development, stated that all the problems which had been delaying construction of a prototype craft had been solved and the last major obstacle, that of efficient shielding, had been overcome.

A study of the Technical Press leads one to believe that English writers have doubts about the practical future of nuclear-powered aircraft, even after the difficult design and operational problems have been satisfactorily solved. The Soviets and the Americans, however, consider that an operational nuclear-powered aircraft is an urgent military need.

In 1955 a senior representative of the U.S.A.F. stated that the development of a nuclear-propelled aircraft was in the second highest priority for development projects, the objective being an aircraft that could take off from the U.S.A. and travel to any part of the World, returning to base without landing elsewhere (8).

In view of the reported progress that has been made in developing nuclear energy for the propulsion of aircraft, it would appear to be an appropriate time to review the problems posed by making a survey of the literature published over the past 10 years, summarizing the opinions of various writers.

Why Nuclear-powered Aircraft?

Whilst aircraft speeds have increased rapidly during the past seven or eight years, range has lagged behind. In fact, the 1946 record non-stop flight of 11,235 miles, without refuelling, by a Lockheed P2V navy patrol bomber still stands (17).

The limitations on the possible performance of chemically fuelled aircraft are illustrated in Fig. 1, where the required gross weight is plotted against range for various speeds. For each given speed the required gross weight increases with range as the amount of fuel required increases. At a certain range the curve becomes practically vertical. Therefore it is impossible to design an aircraft of greater range for the particular speed.

Similarly, it can be said that as speed is increased the gross weight for a given range increases; the maximum range that can be attained decreases as the speed increases. Although the curves are based on certain aerodynamic and structural efficiency values for selected aircraft, the basic shape of the curves remains the same for any chemically fuelled aircraft (16, 17).

The all-up, or take-off, weight of a large modern aircraft such as a bomber is considerable, because of the large fuel load. A few pounds of atomic fuel, on the other hand, could provide a bomber with enough power to surpass the range of any present type of aircraft (6). The one definite advantage that a nuclear-powered aircraft has over one with chemically fuelled engines is unequalled performance combining high speed, long range and almost unlimited endurance regardless of speed (20).

In Fig. 1 a nuclear-powered aircraft would be represented by a horizontal line, because the gross weight is unaffected by range. Beyond the point where this line intersects the curve for the chemically fuelled aircraft of the same speed, the nuclear aircraft will be lighter than the conventional machine. For ranges greater than those where the curves become vertical, the nuclear-powered aircraft appears to be the only one possible (16).

* Hawker Siddeley Nuclear Power Co., Ltd.

Provided that it is practicable, therefore, an aircraft can be designed which would be capable of flying round the World at practically any speed that the designer cares to design into the airframe (3, 23).

Assuming that a very large aircraft exists to carry the heavy weight of a reactor, the question arises of whether or not there is a need for it that cannot be satisfied by one or other form of conventional aircraft—particularly in view of the enormous effort that is required in research and development. It is pointed out that the endurance of a nuclear-powered aircraft could be equalled by a conventional aircraft using flight refuelling and that it was only in very high-speed supersonic aircraft with a range of 4,000-6,000 miles that a powerplant requirement existed that could not be met by conventional engines (23). A case could possibly be made for a subsonic aircraft with a moderate-performance reactor, with supplementary conventional engines to provide short bursts of high speed (5).

Possible Applications

For military application, long-endurance nuclear-powered aircraft could be used, either as long-range bombers for the delivery of fission or fusion bombs, as long-range freighters equipped with parachute-dropping gear, or as refuelling tankers for jet fighters. They would be particularly useful either in conjunction with early warning radar, the aircraft remaining in the air for as long as one month, or on meteorological, search and patrol flight (5, 20).

Nuclear-powered aircraft will probably have no real impact on civil applications for at least 15-20 years (7). The danger of radiation might be avoided by using the nuclear aircraft as a tow-plane for chemically fuelled airliners, the flight pattern being for two or four craft, or even more, in tandem, on the sides, or in layers. The commercial aircraft could carry just enough fuel for take-off, landing and limited cruising, receiving electric power in flight through the cable from the tow aircraft. They would cut loose over the scheduled airport to land by their own power (9, 20).

A possibility, recently suggested by the Goodyear Aircraft Corporation, is a 540-ft.-long non-rigid airship capable of 70-80 kt. that could reach any point in the World from existing U.S. bases. It could be operational by 1963.

A new design approach is necessary for a nuclear-powered aircraft to become a practical proposition. There are many problems peculiar to the installation of nuclear reactors in aircraft, the most important of which include the development of high-temperature materials of construction; techniques of high heat transfer; types of powerplant and their location;

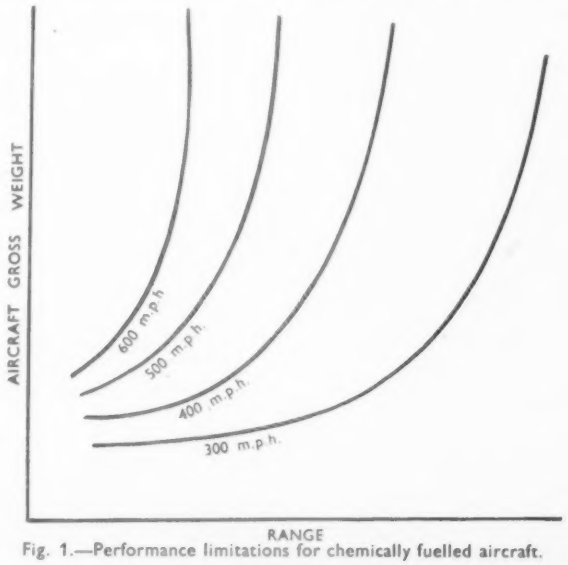


Fig. 1.—Performance limitations for chemically fuelled aircraft.

radiation shielding; the airframe; and the landing gear (20).

The nuclear engine might be considered to be the worst possible type of powerplant that could be conceived for an aircraft. It will be big and heavy because of the shielding required, difficult to control and impossible to approach without considerable safeguards. The working fluids, most likely molten metals, will be difficult to route through the aircraft structure, whilst the waste products from the fission process will be harmful.

Development work on aircraft nuclear plant must follow a different technique from that applicable to jet-engine research. A secluded area is necessary with remote control testing, inspection and maintenance. Flight testing will require new operational techniques to avoid radiation hazards (6).

The Nuclear Powerplant

The nuclear reactor is a source of heat that has to be converted into propulsive thrust. A jet form of power unit is favoured where the nuclear heat source replaces the combustion chamber.

The simplest theoretical form of powerplant would be the nuclear ramjet; but the heat transfer from the reactor to air involves too large a pressure drop, which, in turn, results in a large thrust loss. Another disadvantage that is characteristic of the application of nuclear power to jet propulsion lies in the working fluid (air) becoming radioactive in its passage through the reactor (3).

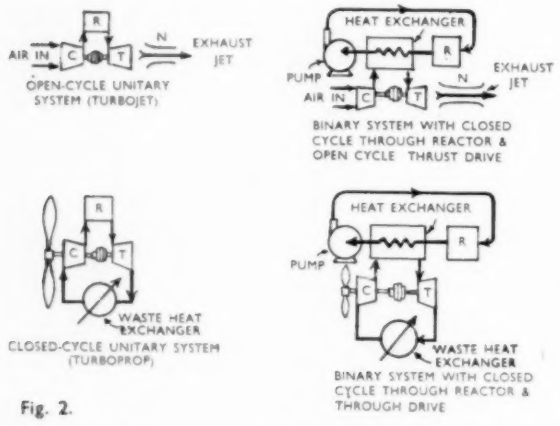

AIR IN
EXHAUST JET
OPEN-CYCLE UNITARY SYSTEM (TURBOJET)
HEAT EXCHANGER
PUMP
BINARY SYSTEM WITH CLOSED CYCLE THROUGH REACTOR & OPEN CYCLE THRUST DRIVE
WASTE HEAT EXCHANGER
CLOSED-CYCLE UNITARY SYSTEM (TURBOPROP)
BINARY SYSTEM WITH CLOSED CYCLE THROUGH REACTOR & THROUGH DRIVE

Fig. 2.

Turbojets and turboprops, however, lend themselves for use with nuclear powerplants in many different combinations of thermal cycles, propulsion devices, etc. (20) (see Figs. 2-5). One writer considers that the only practical form of powerplant is the open-cycle type of system (23).

Of the heat supplied to the powerplant, whether from combustion or fission, 60-75% must be rejected to the atmosphere. In open-cycle gas turbines (and reciprocating engines) this is done by discharging the working fluid (air) as exhaust. In a closed-cycle plant, whether a gas or vapour is used, the waste heat has to be transferred from the working fluid to the atmosphere by using either large heat exchangers or large temperature differences. The latter lowers the cycle efficiency and requires a higher source temperature, a limiting factor with current engineering materials (25).

Some form of heat exchanger will, in any case, be needed in all types of nuclear powerplant. The early systems will present temperatures which will be lower than those of current conventional engines — a factor which eliminates the turboprop on the grounds of excess engine weight. The turbojet seems to be the only choice, therefore, even for subsonic long-endurance applications (23).

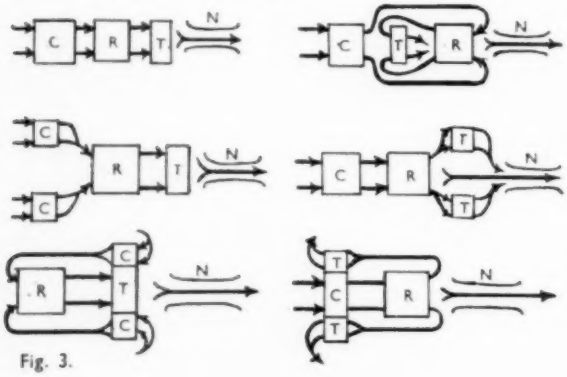


Fig. 3.

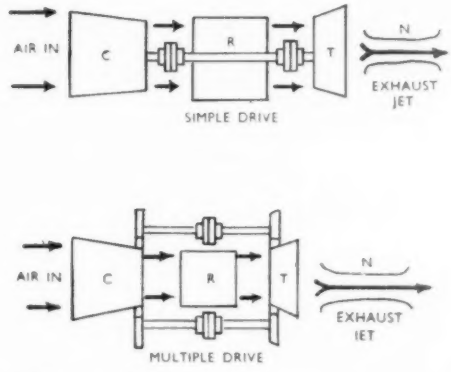


Fig. 4.

Full energy capabilities of nuclear powerplant for the moment seem to be limited. To achieve higher operating temperatures, considerable ingenuity is required to design heat exchangers with greater efficiency than ever before, incorporating characteristics not found in conventional heat exchangers (20).

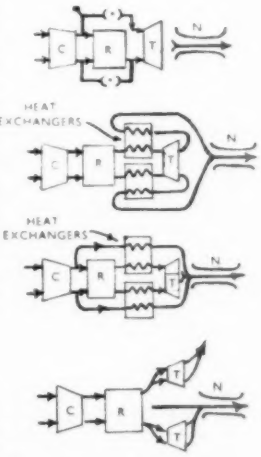


Fig. 5. Turbine exhaust might be wasted or directed into the exhaust.

Choice of Reactors

The main problem in applying nuclear reactors to aircraft propulsion is the development of sufficiently high temperatures. For a gas-turbine propulsion unit these will have to be to the order of 700-800° C. (8).

Another problem is whether or not a sufficiently light nuclear powerplant can be built. Thermal utilization depends critically on the maximum cycle temperature in the gas (Figs. 6 and 7). With low temperatures the utilization will be low and a larger heat exchanger surface is required. A greater volume of air must be passed through the engines to give the required thrust, consequently increasing the number of engines and drag. The reactor then must have a higher rating with the penalty of a larger core and increased amount of shielding.

With the direct-air cycle, where air as the working fluid passes from the compressors through the reactor, the basic reactor would be heavy and bulky. Apart from shielding considerations, however, the system is workable inasmuch as air is available in abundance (3).

Incorporation of an intermediate liquid-metal cooling system would improve heat transfer and greatly increase the power available from a given reactor (3, 5). Such an arrangement might possibly reduce the pressure drop that is incurred.

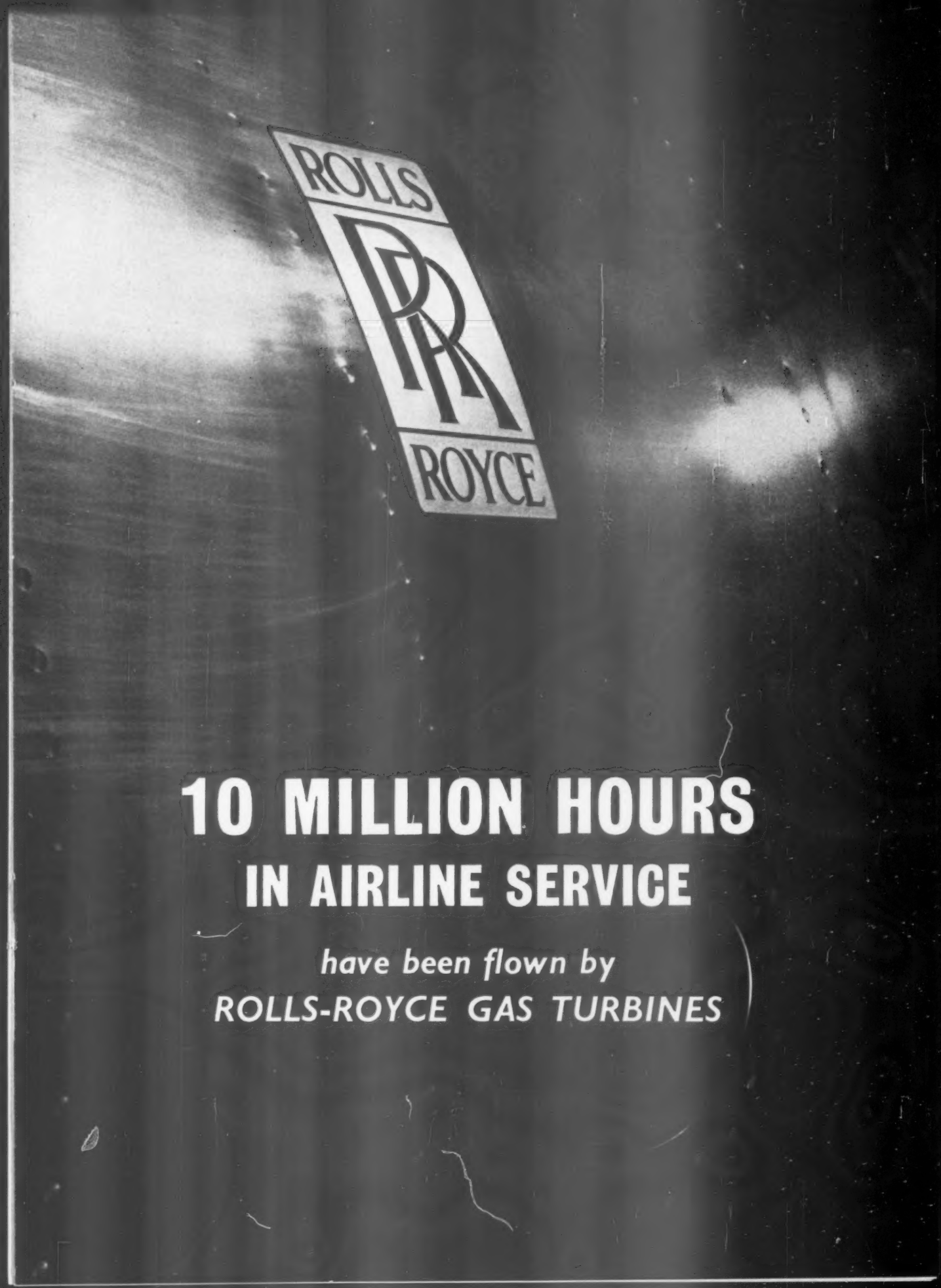
It has been suggested that further improvements could result from using a liquid-metal coolant, e.g. bismuth, to carry the fissile material as a dispersion or solution through the core. Fuel concentration is limited by the solubility of uranium in bismuth and the core would have a somewhat larger critical size than one with fuel elements. The use of uranium slurries might reduce the size however (24).

Temperatures up to 550° C. are considered possible in liquid-metal-fuelled reactors. The L.M.F.R. offers distinct possibilities for application to gas-turbine powerplants, provided that higher temperatures can be developed, possibly through improvements in corrosion-resistant materials for containing uranium-bismuth solutions (24, 25).

Another possibility is a reactor with a ceramic uranium carbide or oxide core heating helium gas, the latter having negligible neutron capture cross-section and excellent heat-transfer properties. Used in a closed cycle, high temperatures in the ceramic will permit high temperature differences between fuel and gas enabling the design of a reasonably small core, even with the comparatively low heat-transfer coefficient.

It is suggested that the use of high-temperature ceramic fuels

(*Continued on page 637*)



10 MILLION HOURS
IN AIRLINE SERVICE

have been flown by
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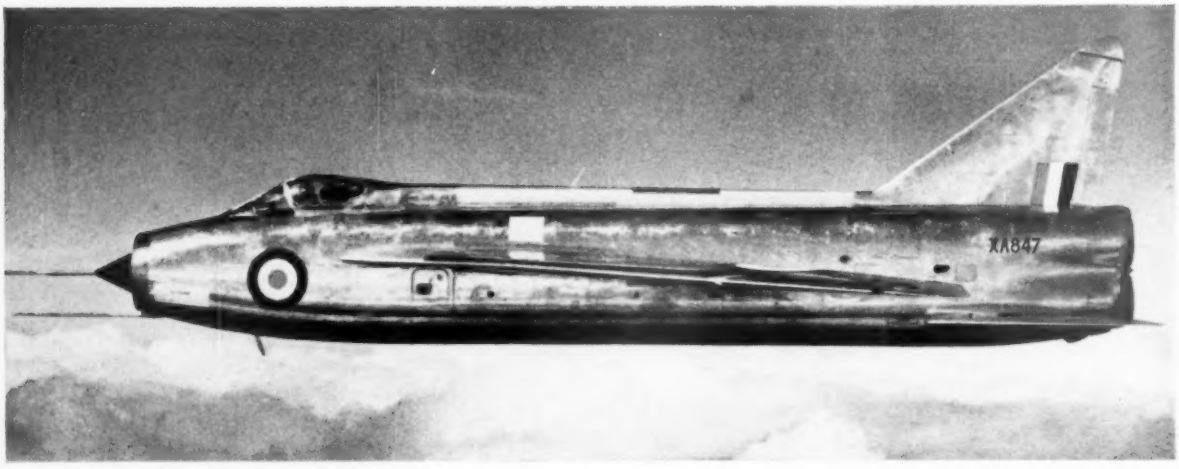

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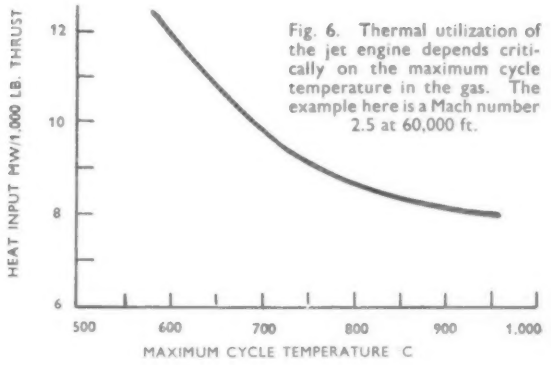


Fig. 6. Thermal utilization of the jet engine depends critically on the maximum cycle temperature in the gas. The example here is a Mach number 2.5 at 60,000 ft.

(*Continued from page 636*)

might overcome the inherent problem of the closed-cycle system, that of transferring waste heat to the surrounding atmosphere (24). For optimum design the core should be as small as possible so that the shielding mass is reduced to the minimum.

The fast neutron reactor might be a possible alternative, therefore, particularly because of the greater range of high-temperature materials that can be used. Heat transfer problems will be acute, however, and liquid metals will have to be used to control heat removal. Another disadvantage is the high fuel investment that is necessary to sustain the chain reaction (3, 12).

Radiation Shielding and Airframe Design

The weight of adequate shielding to protect the crew, instruments, cargo and ground staff is a serious problem in mobile applications and a departure has to be made from the shielding standards of land-based reactors (23).

Assuming that the designer is ingenious enough to extract 100 MW of heat from a reactor core consisting of a 2-ft. diameter right cylinder and that a shield thickness of about 4 ft. is acceptable, according to Cockcroft the shield weight will be about 50 tons. Therefore an aircraft weighing more than 100 tons will be necessary to carry this unit (8). The weight given for a Russian two-engined nuclear turbojet design, with a range of 540,000 n. miles, is 286,000 lb. (33).

Generally speaking, in conventional aircraft design, structure, engines, crew, controls and accessories add up to about half the design gross weight. The other half is distributed approximately between the cargo and fuel. For a nuclear-powered aircraft to compete successfully on a payload/gross weight basis with conventional designs, reactor and shielding must not exceed 25% of design gross weight (21).

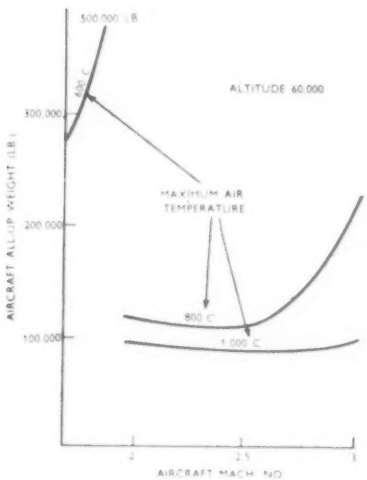


Fig. 7. Overall effect for various Mach numbers with the maximum air temperature as a parameter. At Mach 2.5, a maximum air temperature of at least 800°C is desirable, a figure which should be exceeded for higher Mach numbers.

The main design problem then is the highly concentrated weight of the reactor shield assembly. This is of the order of 100-200 lb./cu. ft., as compared with 20-25 lb./cu. ft. of modern turbojets or 50 lb./cu. ft. of typical chemically fuelled aircraft (14).

Weight reduction is likely to come from ingenious shielding design. A likely shielding arrangement in an aircraft might consist of a very thick layer of lead immediately next to the reactor with further layers of boron or lithium (for neutron capture) interspersed with iron (12).

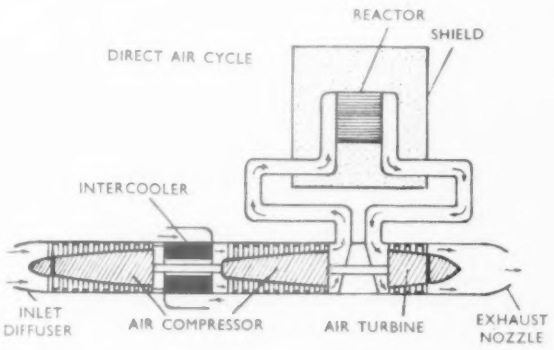
Apart from reducing weight by new shielding design, reduction would also result from locating the crew as far from the reactor as possible, thereby gaining from the square law of attenuation with distance (23). This will also help to avoid the congestion of structural weight and the weight of disposable loads at the aircraft's centre of gravity.

Aircraft shielding can be designed in several ways. The Unit Reactor Shield, where only the reactor is protected, seems to be an attractive approach from the point of view of ground handling, cargo, and airframe radiation dose rate; but it has severe weight penalties.

With Split Shielding sufficient shielding has to be placed round the reactor to protect the aircraft, whilst additional shielding protects the crew compartment. This pattern involves landing and take-off problems due to ground scatter from reactor to crew. A conventional power unit for take-off and landing might ease this problem (9, 17). Split shielding, however, leads to difficult crew-cabin design and heavy shielding near the nose, thereby necessitating heavier fuselage structure.

Research has been made in the U.S.A. into shielding requirements and it is considered that the design difficulties are no longer insurmountable (4).

The usefulness of the nuclear-powered aircraft is very much dependent on whether or not it can use existing airfields, carry all types of cargo, operate without extensive and complicated ground-handling facilities, particularly at overseas bases (6).



The reactor replaces the turbojet's combustion chamber. Use of direct air cycle obviates the need for a liquid circuit.

Long runways will be necessary because, apart from being a very large aircraft, the landing weight will be as great as the take-off weight, resulting in high landing speeds (20, 23).

The number of available airfields will, therefore, be limited—a factor that may favour the use of flying-boats or amphibians during the early development stages, provided stretches of sheltered water of more than two miles can be found (20). On the other hand, the high endurance and long-range characteristics of nuclear aircraft will facilitate return to base or some other specially equipped landing field.

Control of power level will be quite different from that in conventional aircraft. The pilot will not be able to get immediate power increase because the heat transfer processes will react more slowly than internal-combustion engine controls (20). An abortive landing attempt would be most hazardous, therefore, unless additional thrust was available, provided by auxiliary rocket engines or some other powerplant type (8, 23).

Another problem facing the designer of mobile reactors is the build-up of radioactive waste products and the probability of having to remove the fuel for reprocessing after about only one-third has been consumed (8, 9).

The most important deterrent to the operation of nuclear aircraft, however, is the crash hazard. The fission products, which are highly radioactive and extremely poisonous, continue to release heat even after shut-down, as much as 10% of normal operating power. After a crash, it is unlikely that the cooling system will operate and there is the danger of a rapid increase of heat within the reactor causing the fuel to melt and burn through its containment vessel (5).

Considerable amounts of fission products will be released to the atmosphere in vapour form producing lethal effects a long way down-wind. The area of the crash will be inaccessible for a period of time possibly extending to years. Fires will also occur through vaporized sodium and/or uranium contacting the air. A high-temperature reactor using ceramic fuels, however, would lessen the spread of fission products (9, 23).

The American Research Programme

The only published information readily available on actual research and development work is that from the U.S.A. The N.E.P.A. Project (Nuclear Energy for Propulsion of Aircraft)

started before 1950, is concerned with the development of reactors suitable for aircraft propulsion and missiles, the improvement of shielding techniques, extensions of technology applicable to high-temperature materials and moderators, improvement of coolants, methods of power conversion and improvement in power density. (See "Nuclear Science Abstracts" for numerous reports.)

	Start-up
Ground Test Reactor (U.S.A.F.). 500 kW, pool type. Operated by Convair at Fort Worth, Texas	1953
Aircraft Reactor Experiment. Fluoride salt fuel. Operated at Oak Ridge National Laboratory. Dismantled	1954
Aircraft Shield Test Reactor (U.S.A.F.). 1 MW. Light water. Operated by Convair at Fort Worth	1954
Tower Shielding Reactor No. 1. Oak Ridge. 500 kW, tank type	1954
Heat Transfer Reactor Experiment (HTRE I). G.E.C. (Direct Air Cycle.) Dismantled	1957
Radiation Effects Reactor (U.S.A.F.). 10 MW, pressurized water. Operated by Lockheed	1959
Tower Shielding Reactor No. 2. Oak Ridge. 5 MW	1959
NACA 60-MW (heat) light water reactor. For use in research on a nuclear-powered aircraft engine	Jan. 1960
Nuclear Engineering Test Reactor (U.S.A.F.). 10 MW, pool type. Operated by A.C.F. at Dayton, Ohio	after 1960

The Aircraft Reactor Experiment (1)

The A.R.E. was designed for operation at temperatures in the region of 815° C. at a power of 1-3 MW with a fluoride salt fuel circulating in a heterogeneous core. The moderator, in the form of beryllium oxide blocks, is cooled by sodium. The heat produced is dissipated in water through liquid-to-helium-to-water heat exchange systems. The experiment was first successfully operated in November, 1954, when a maximum steady-state fuel temperature of 860° C. was reached with a differential temperature between inlet and outlet of 168° C.

The fuel, a mixture of the fluorides of sodium, zirconium and uranium, was contained in Inconel. The reactor, which is considered to be extremely stable and completely power-demand responsive, is controlled mainly by manipulating the flow of cooling helium gas to the heat exchanger, control rods being used for setting the operating temperature level.

The Aircraft Shield Test Reactor (2)

The first nuclear reactor to go critical whilst airborne was the 1-MW (heat) ASTR designed by the Convair Division of General Dynamics Corporation primarily to provide a radiation source for airborne shielding studies. It was carried in the aft bomb bay of a B-36 aircraft. This happened on September 5, 1955, following three years of development and research. The reactor core consists of an array of 34 highly enriched uranium plate-type fuel elements.

Demineralized water flowing at 500 g.p.m. in a two-pass-system serves as moderator, reflector and coolant. The shielding arrangement allows wide flexibility for the airborne shield testing. Any of the nine shield tanks can be drained or filled by remote control with aqueous solutions. The forward shadow shield assemblies can be filled with air, lead or aqueous solutions, and 26 different shielding configurations are made possible by suitable combinations of filled and empty shield tanks.

Special maintenance and loading procedures were successfully developed. The problem of excess radiation after landing was overcome by shutting down the reactor after completion of the data runs and, during the return journey to base, circulating cooling water through the core to remove residual heat. Before landing, moderator water was drained from the core.

Convair's reactor has now been transferred to the Oak Ridge National Laboratory, where it will be suspended from the four 300-ft. towers forming the Tower Shielding Facility for further radiation testing leading to the design of protected crew compartments.

The Lockheed Aircraft Corporation is having two reactors for its nuclear test facility at Dawsonville. C.E.R., the Critical Experiment Reactor, which started up in 1958, is being used primarily for checking core configurations of the Radiation Effects Reactor which is to be used to determine the suitability of aircraft constructional materials to withstand radiation.

Flying-boats

Preliminary studies have already been made by the Grumman Aircraft Engineering Corporation on the fast neutron effect of materials used for the hull bottom of amphibian aircraft. (See: Reports NP-6438, NP-6507.)

The U.S. Navy has been considering the use of the Saunders-Roe Princess flying-boat for the first U.S.A. nuclear-powered aircraft. A contract study for the whole problem of fitting a nuclear powerplant into a sea-going aircraft has been issued to the Martin Co. of Baltimore. This study, which is to include investigations into airframe and nuclear powerplant, is expected to be completed within six years.

Following preliminary studies by Lockheed and Convair, a U.S.A.F. contract for the initial design of a nuclear powered bomber prototype has now been given to Convair working in conjunction with the Nuclear Propulsion Division of General Electric.

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Astronautics and Missiles

British Astronautics—2

The first instalment of this two-part article by KENNETH W. GATLAND *outlining British contributions to the theory and practice of astronautics was given in our issue for December 11.*

DESPITE the long history of the British Interplanetary Society in the astronautics field, it was to the Royal Society that the Government turned for advice in deciding whether or not the nation should engage in space-research.

The Royal Society's recommendations were studied in detail by the Advisory Council on Scientific Policy, and as a result, a programme of physical research into the properties of the outer atmosphere, using American Scout rockets, was formally approved. This, as we have already pointed out, is little more than an extension into orbit of the research studies initiated by the Royal Society's Gassiot Committee, which led to the development by the R.A.E. of the Skylark rocket of 100 miles vertical range.[1]

Proposals Obscure

So much hangs on the actual proposals made by the Royal Society that it would be helpful to review the document which was, or should have been, the basis of the A.C.S.P.'s actual recommendations to the Government. Unfortunately, the content of this document has never been publicly revealed.

Did the Royal Society restrict its survey of the potentialities of space-science to purely instrument research, or did it also consider the broader, and industrially more significant, aspects such as communication and navigation satellites? What did the Society have to say on the military uses of artificial satellites? Did it go into the question of manned space-flight in its relationship to the future of high-performance aviation —boost gliders, for example?

One can only remark that if these things were not considered at length by the appropriate experts, the Government has been presented with an exceedingly narrow picture of the future of astronautics.

TABLE 1

Type	Project	Description
Communication	Echo	100-ft.-dia. inflatable satellite, passive reflector.
	Courier	Delayed-action repeater.
	Decree	Equatorial 24-hr. orbit instantaneous repeater.
	Steer	Polar orbiting instantaneous repeater.
Navigation	Transit	Providing precise "fix" for sea and air transport.
Meteorology	Tiros	TV pictures of Earth cloud-cover, etc.
Reconnaissance	Samos	Experimental surveillance system; related to Discoverer.
Early Warning	Midas	Infra-red detection of ICBM launchings.
Capsule recovery	Discoverer	Stabilized satellite; related to Mercury.
Manned re-entry (capsule)	Mercury	Non-lifting satellite recovery.
Manned re-entry (glider)	Dyna-Soar	Controlled satellite recovery by lifting vehicle.
	Mrs. V.	Development of Dyna-Soar for manœuvring in orbit.

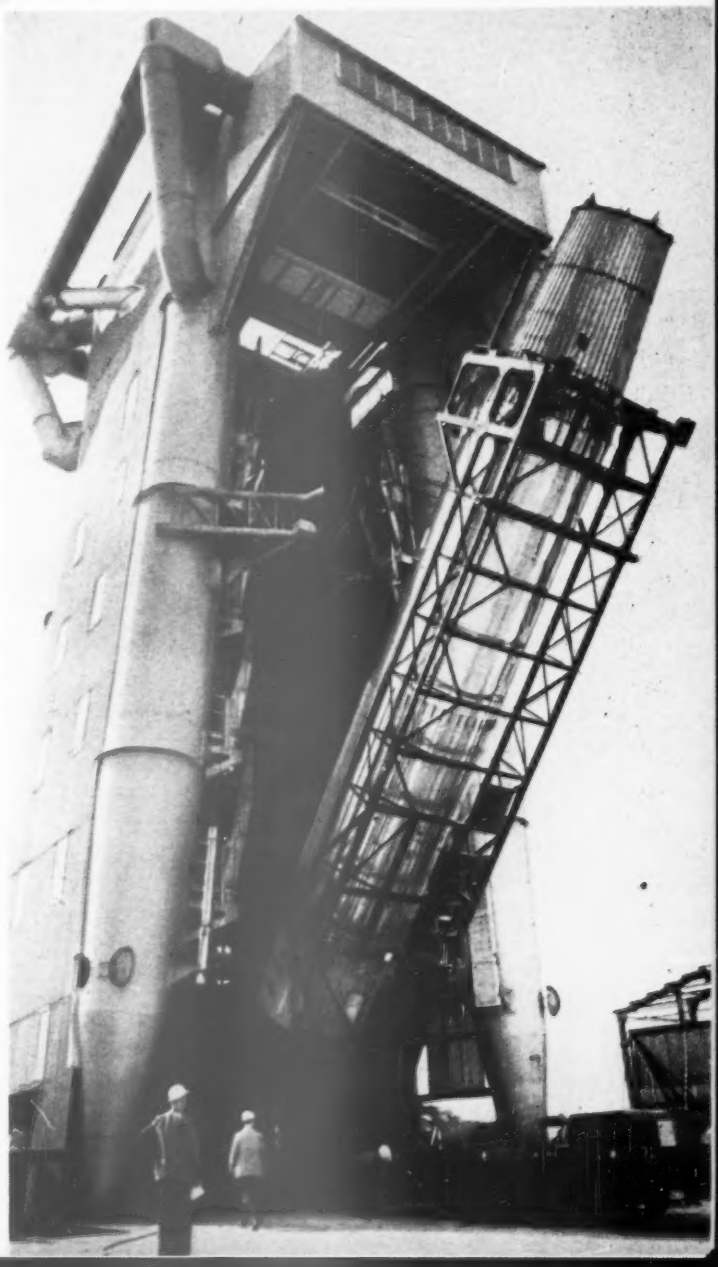
American satellite projects of commercial or military interest.

Blue Streak and Black Knight

On the question of launching vehicles, was it really true, as suggested elsewhere, that the Royal Society's original proposals were based on an all-British programme of satellite research using Blue Streak and Black Knight, and that this was turned down by the Advisory Council in favour of the American rocket? If this really was so, this decision carried to its logical conclusion could make us dependent on the Americans for any experiments we may subsequently wish to make in practical fields of satellite development.

In the Commons last May, the Prime Minister did, in fact, state that design studies of satellite launching vehicles, based on existing British rockets, were being put in hand "to put us in a position, should we decide to do so, to make an all-British effort."[2] But from the latest report of the A.C.S.P., it would seem that even this possibility is remote at the present time.

In view of the uncertainty that exists over the advice the Government received, or whether in fact the A.C.S.P. acted on the Royal Society's principal recommendations, it may be of interest to note the major fields in which the Americans are now working. These range (Table 1) from the physics of the outer atmosphere and space outwards to the planets, to a growing number of undertakings of obvious practical value, such as satellites for relaying radio, television, telephone and



A de Havilland Propellers Blue Streak being raised into a servicing tower at Hatfield.

telegraph services around the World. Other satellite projects are concerned with the navigation of ships and aircraft, and advance warning against ICBM attack. One outcome of research with cloud-cover satellites is expected to be a comprehensive weather forecasting service on a global scale, while the use of close-orbit satellites for the purposes of military reconnaissance is also being closely studied.

In addition, there are, of course, the two major "man-in-space" programmes, centred on the Mercury space-capsule and the Dyna-Soar boost-glider. The implications of the foregoing cannot be forecast with any degree of certainty save to say that, other than hastening the day when man lands on the Moon, these vehicles may well have a big future in high-performance aviation.

Can we afford to contract out of these essentially practical developments of space-flight and remain a leading nation in science and technology? These are matters which, surely, we must expect to be pondered seriously by the Government.

Yet, on Dec. 8, the Advisory Council on Scientific Policy saw fit to issue a report drawing attention to the high cost of space-research, and stated that only the most wealthy nations could afford a national space-programme.

In view of the insight this statement gives into the thinking of the Government's advisors, whose A.C.S.P. panel is composed of an ornithologist, a doctor, a botanist, a zoologist, a physiologist, an agricultural expert, a nuclear physicist, and an aircraft designer—but no rocket expert—we include the relevant passages of the report herewith:—

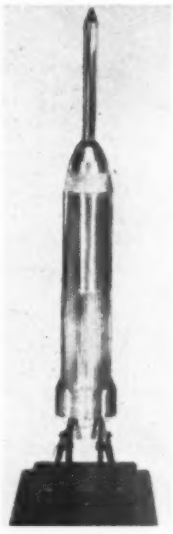
"Carefully designed experiments using Earth satellites," it says, "can contribute to the answer of a number of important scientific problems and, in many cases, may well prove the most economic method of obtaining the required data. Because the cost of venturing into space with lunar, planetary or solar probes, would be too great for our resources, and because we do not think that the scientific and technological return to be expected is likely to be commensurate with that cost, we have not recommended any British participation in these activities at the present time, nor in the attempt to launch human beings into space.

"Although much scientific effort is being expended by the United States and the U.S.S.R. on satellite work, and valuable results have already been obtained, we are convinced that there is plenty of work still to be done which will provide material for a useful programme for our scientists for many years to come. The cost of the present programme, which has been estimated at between £100,000 and £200,000 per annum for the next few years, is not out of line with other programmes of scientific research of similar importance. This figure does not, of course, include the cost of the launching vehicles or of the possible adaptation of British rockets to provide such vehicles.

"The Council recognized that the scientific programme at present authorized would not in itself have a significant impact on British industry, apart from some stimulus to developments in micro-instrumentation. They did not consider that the technological advantages likely to accrue from the development of a British rocket and satellite programme designed for civil purposes, over and above the existing military missile programme, would be sufficient to justify the considerable expenditure involved.

"To shoulder the crippling cost of a large programme of space exploration on a purely national basis at the expense of adequate expenditure vitally important for the welfare of our people as well as the improvement of living standards in the less well developed countries would, in the Council's view, be the grossest folly.

"Here, surely," the report continued, "is a situation in which the proper solution lies in a co-operative effort by all nations. We believe that British science and technology have much to contribute in this field and that they should do so. . . . We, therefore, consider that every effort should be made to establish such an international co-operative effort, and we particularly welcome the newly established co-operative agreement with the United States as a step towards this goal."



Model illustrating a possible adaptation of the de Havilland Propellers Blue Streak and Saunders-Roe Black Knight for satellite launching. This photograph was issued by the Ministry of Supply last June.

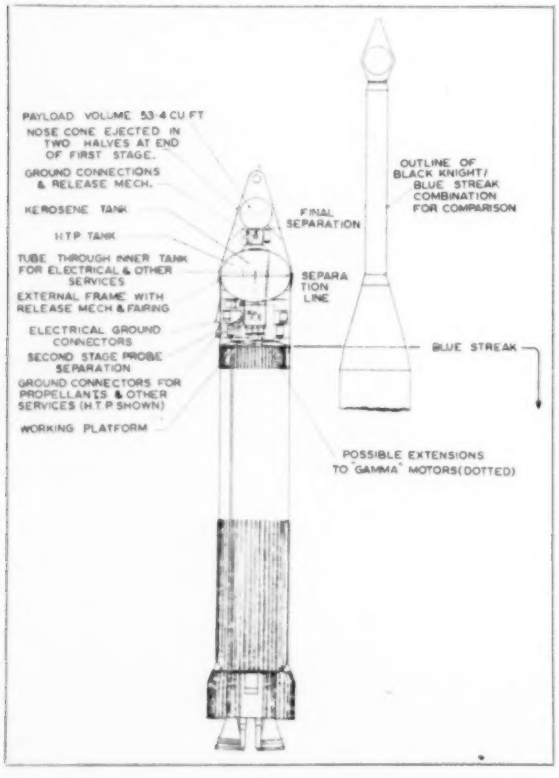
Practical Outlets

Now, in contrast, let us read the words of Dr. T. Keith Glennan, Administrator of America's National Aeronautics and Space Administration; he was speaking before the Institute of World Affairs in Pasadena, California, on Dec. 7, and devoted much of his address to the practical outlets for astronautics. "The NASA objectives," he said, "include the investigation of the uses of artificial satellites to perform more efficiently and effectively some tasks which are now carried out by other means and to perform other tasks which cannot be done at all with present means. The applications which seem most promising at present are those directed towards weather observations, analysis, and forecasting on a global scale; the improvement of long-distance radio-communication; the study of the size and shape of the Earth and of the distribution of land masses and water; and all-weather global navigation. It is believed that such applications brought to successful fruition will improve the well-being of mankind everywhere."

One wonders how much attention the Advisory Council has given to these matters. It is scarcely necessary to be reminded that astronautics is expensive, but if important new techniques are emerging beyond those of scientific exploration of space and the planets, it is surely essential that we gain first-hand experience. In any case, we should not seek to emulate America in striving to accomplish everything in the astronautical field at once, and what *we* should spend, even on a "major" programme, would be only a fraction of what *they* expect to spend over the next 10 years.

Of all nations outside Russia and America, we are in the best position to embark on a useful programme of astronautics for, within the Commonwealth, not only have we an excellent overland range but also a most potent rocket system in the Blue Streak and Black Knight. At the recent Commonwealth Spaceflight Symposium, Mr. H. J. Higgs, the W.R.E. representative in London, made it clear[3] that Woomera could be adapted for satellite launching and, at the same meeting, Mr. G. K. C. Pardoe of de Havilland Propellers gave some ingenious solutions[4] for a speedy development of the Blue Streak and Black Knight to orbit a payload of 1,000 lb.

We thus have all the basic ingredients of a space-programme which could effectively carry us into the province of practical

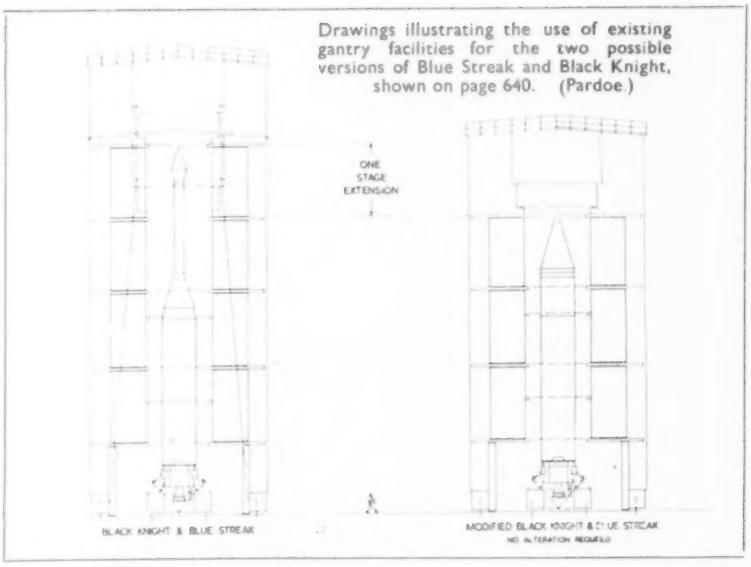

PAYLOAD VOLUME 53·4 CU FT
NOSE CONE EJECTED IN TWO HALVES AT END OF FIRST STAGE.
GROUND CONNECTIONS & RELEASE MECH.
KEROSENE TANK
H.T.P. TANK
TUBE THROUGH INNER TANK FOR ELECTRICAL & OTHER SERVICES
EXTERNAL FRAME WITH RELEASE MECH & FAIRING
ELECTRICAL GROUND CONNECTORS
SECOND STAGE PROBE SEPARATION
GROUND CONNECTORS FOR PROPELLANTS & OTHER SERVICES (H.T.P. SHOWN)
WORKING PLATFORM
FINAL SEPARATION
SEPARATION LINE
OUTLINE OF BLACK KNIGHT/BLUE STREAK COMBINATION FOR COMPARISON
BLUE STREAK
POSSIBLE EXTENSIONS TO 'GAMMA' MOTORS (DOTTED)

Possible configuration for a satellite launching vehicle employing Blue Streak and a second-stage rocket, based on the Black Knight, but considerably reduced in length. A more conventional arrangement of Black Knight is given for comparison. (Pardoe.)

developments, from communication satellites to the beginnings of manned spaceflight—all existing and paid for under the military budget. The necessary additional work to adapt the Blue Streak and Black Knight would be small compared with the sum already invested, but the experience we should gain in new techniques would be immeasurable.

This does not, of course, mean that where the opportunity exists we should not co-operate with other countries. But can we expect real co-operation with the United States, or anyone else, unless in turn we have something to offer? Will other countries be willing to turn over to us, without some reciprocal gesture, all their technical reports and memoranda which, subsequently, we may be eager to receive?

The alternative to entering the spaceflight picture is that we should continue to develop instruments and allow the Americans to fire them into orbit; and, no doubt, this would satisfy the Royal Society's purely scientific interest in space-research. But by no stretch of the imagination would this allow our industry to gain the experience it may need in the future.



Drawings illustrating the use of existing gantry facilities for the two possible versions of Blue Streak and Black Knight, shown on page 640. (Pardoe)

Thoughts of a common interest among various nations raise the question of whether, in fact, Britain and the Commonwealth might join forces with European countries in astronautics, on the lines in which several nations are already co-operating in nuclear power. Certain projects, by their nature, seem certain to affect other European countries ground stations for TV and other radio-repeater satellites, for example—and some enterprising nation could easily become the main link in a comprehensive system of communications.

Once again, Jodrell Bank has shown the way experimentally, for communication links have already been made with a station in America using the Moon as a "reflector" for radio signals[5]. Next spring, the giant radio-telescope is expected to be used again in providing a European link with North America, during experimental transmissions in which 100-ft. dia. inflatable satellites will serve as reflectors at 1,000 miles altitude.[6] However, if we are to take advantage of this pioneer work, it is essential that our electronics industry is enabled to get to grips with the problems of helping to develop this system for commercial use.

There are, of course, many other ways in which we may share research activities with other countries. In aviation, for example, the running down of military aircraft has been inevitable and much useful experience will be lost when it comes to designing supersonic—and, dare one say it—hypersonic transports. Yet it is difficult to foresee any really major technical advance in aviation which does not involve higher speeds and altitudes, and the demarcation line between aeronautics and astronautics may be difficult to find in the future. The boost-glider is a case in point. A rocket, or rocket/ramjet combination, is required to accelerate it to hypersonic speed, and the vehicle itself owes something to both aeronautics and "space-ballistics."

Can we afford to be without experience in the new era of flight? If we neglect it, our design and research teams will be starved of experience, and the associated electronics and light engineering industries which depend on high-performance aviation will also suffer.

In John Allen's comprehensive paper given at the Commonwealth Spaceflight Symposium[7], the author quoted eight incidental advantages which may be expected to accrue from space-technology. These were: (a) Miniaturized electronics, radio, radar and computing devices; (b) Means of vastly improving the reliability of complex electro-mechanical systems; (c) Exploitation of new metals, alloys and fuels; (d) Small nuclear power devices; (e) Better devices for converting solar energy for useful purposes; (f) Artificial production of food; (g) Better understanding of biological processes, and, significantly, (h) All the things we have not found out yet!

It seems inevitable, therefore, that lack of initiative in the space-sciences will be reflected all down the line in a wide variety of fields outside the immediate province of aviation and space-flight.

How, then, could we go about shaping a programme of astronautics? Mercifully, we are spared the turmoil of a "prestige" race and can be selective in what we attempt. The last thing we should want is a space-programme striving to cover every possible field of interest, and it is for this reason that we should be very sure of our objectives. A comprehensive technical assessment, conspicuously lacking at the present time, is needed to determine *all* the opportunities for space-research and development, and the authorities could very well spend the next 12 months in obtaining one from people who really know the subject. This clearly is a job for industry, the Government establishments and the recognized engineering and scientific agencies. Indeed, on their own initiative, several companies have already expressed their thoughts on various aspects of astronautics at the Commonwealth Spaceflight Symposium which the British Interplanetary Society organized last August.

So far as launching vehicles are concerned, the same combination of Blue Streak and Black Knight as used to launch research instruments or a communications satellite could equally be used in developing boost-glide techniques. Within three to five years, half-scale vehicles on the lines of the A.W.A. "pyramid" re-entry glider[8] could be launched using these two rockets, according to Dr. W. F. Hilton, of the Advance Project Group, Hawker-Siddeley Aviation.

Table 2 gives a summary of a possible 10-year programme

TABLE 2

Vehicle	Date	Purpose	Notes
Skylark	1956	Upper atmosphere research (altitude approx. 100 miles; payload 50/150 lb.).	First British high-altitude rocket.
Black Knight	1958	Re-entry research; upper air physics (altitude approx. 500 miles).	No failures in five consecutive launchings.
Black Knight two-stage	1960	Re-entry research; higher velocities.	Addition of solid-propellent top stage.
Black Knight three-stage.	1961	Orbit 10 lb. at 300 miles.	Simple development from existing two-stage vehicle to satellite launcher.
Blue Streak	1960	Intermediate-range ballistic missile; approx. range 2,800 miles.	Approx. equivalent to U.S. Titan ICBM first stage.
Scout	1961	Orbit 150 lb. at 300 miles.	American 4-stage, all-solid vehicle; to be used to orbit British instruments.
Blue Streak/Black Knight.	1962	Orbit payload of 1,000 lb. plus at 300 miles.	Straightforward adaptation of two existing rockets, making possible initial experiments with communication satellites, etc.
Blue Streak/high-energy top stage.	1965	Orbit payload of 4,000 lb. plus.	Manned re-entry research. (Boost-glide prototype.)
Booster with clustered Blue Streak engines/ Blue Streak/high-performance top stage.	Late 1960s	Orbit payload of several tons.	Large satellite research; development of boost-glide techniques. Experiments in booster recovery.

Opportunities open to a British Commonwealth, or Commonwealth-European, astronautical programme integrated with the U.K. ballistic missile programme over the next 10 years. (Projects actually in being, italicized.)

of spaceflight based on rockets already developed in the U.K. military programme, with further developments which might stem from this basic equipment. A co-operative programme would not necessarily restrict its development to existing vehicle combinations. In the years ahead, the addition of a high-performance upper stage for Blue Streak, using perhaps liquid hydrogen/liquid oxygen, would enable a useful space-programme to be continued for perhaps a decade using this one basic booster. A vehicle of this kind would probably be capable of launching a manned re-entry glider capable of ascending into orbit, making a few orbits of the Earth followed by re-entry and landing.

Neither would this be the limit of available booster hardware, for the development of a vehicle clustering four, six or eight Blue Streak engines could follow as the programme got under way. Thus, heavier payloads could be lofted into orbit, or deep space missions could be planned, as the need arose. All this should be within the province of a joint British Commonwealth-European programme, linked with the United States.

Boost Recovery

Other factors would become increasingly important as the programme develops. With the increasing frequency of launching, the need will arise to recover the expensive boost components of the vehicle complex, and in the end satellites, both unmanned and manned, may well be launched by hypersonic aircraft which, having released the rocket stages, will return to base and land.

Another vital factor in any space programme is reliability. The British record of developing the Black Knight for only £5 million and then firing five out of five rockets successfully to altitudes ranging from 300 to 500 miles,[9] shows that we are as good as anyone in rocket engineering. Moreover, we have proved that we can perform a complex engineering task at less cost than is possible in America. Nor must we forget that by concentrating on reliability, we are evolving standards which will be vital in putting man into space. Again, it is unnecessary to stress the importance of reliability in the electronic and electro-mechanical equipment needed for a long-life commercial TV repeater satellite, for example. A by-product of experience in this field will almost certainly be improved industrial automation.

Disarmament

One last point concerns the fate of such expensive military projects as the Blue Streak if nuclear disarmament becomes a reality. Without its thermonuclear warhead, the missile would be virtually useless as a weapon, but under the space-budget, its development could continue and it would serve a useful function.

Neither should the point be overlooked that, under full disarmament, a nation may agree to put away its military rockets and space-projects but would legitimately maintain to the full its experience in the most advanced techniques of space-ballistics and boost-glide flight. Thus, in the future, America and Russia could agree to disarm without either dropping its guard too far.

In the final analysis, a nation such as our own, which lives so largely on the initiative and ingenuity of its scientists and engineers, cannot afford to allow its technology to come to a halt in any direction. The facts speak for themselves. There is clearly a technological case for space-development as well as a scientific case. And for this reason, if no other, the Government sooner or later will be forced to take action.

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Cancellation of Vega

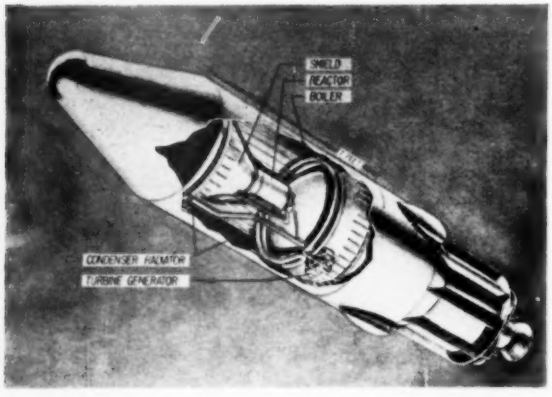
FIRST major rocket project to be "re-evaluated" after the reorganization that has recently taken place in the American space-programme, is the multi-stage Vega which the National Aeronautics and Space Administration announced on December 11 had been discontinued. Since NASA now embraces such costly projects as the giant Saturn booster—and the even larger Nova—some reorientation was inevitable, and vehicles which represent only a small improvement on other vehicles in the programme are liable to be eliminated.

At all events, this action has been taken in the case of Vega and other rockets will now undertake the satellite and space probe missions for which this vehicle was planned. Within Vega's capabilities were orbiting a payload of 7,400 lb. at 300 miles, or 1,300 lb. at 22,000 miles, and soft-landing 730 lb. on the Moon. A major objective over the next three to four years was stated to have been an extensive survey of the Moon's surface, the intention being to place Vega's final stage in orbit with a TV camera as part of the payload.

The launching vehicle was being developed both as a two-stage and three-stage rocket. In each case, the first stage would have been a Convair Atlas and the second stage a rocket using a General Electric engine of the type originally used in Vanguard. This latter engine was being modified to permit starting and re-starting at altitude. In Vega's third stage it was proposed to use the 6,000-lb. thrust J.P.L. "storable" propulsion unit, but this will now be reserved for other advanced space-vehicles.

Vehicles which will take over missions originally assigned to Vega will be the Atlas-Agenda and the Centaur, both with Atlas initial stages. The Agenda rocket will use a Bell Hustler second stage while the Centaur—the more distant project—will have the high-energy, liquid oxygen/liquid hydrogen XLR 115 engine, being developed by Pratt & Whitney.

Another outcome of the abandonment of Vega may be that additional Atlas rockets will become available for further attempts to launch probe vehicles to the Moon, using the Atlas-Able combination.



SPACE POWER.—Artist's impression of the Snap II "atomic generator" aboard a satellite of the Discoverer-Agenda series.

Satellite Atomic Generator

ONE of the great needs of an artificial satellite intended to operate continuously and unattended in space is a power unit for generating electrical energy. One method, already in use, is the solar battery which converts sunlight directly into electricity; another, offering high output for periods of a year or more, is the atomic reactor.

A compact atomic power unit weighing only 220 lb. has recently been tested by Atomics International, a division of North American Aviation, Inc., which has been developing the project under contract with the Atomic Energy Commission. Called the Snap II Experimental Reactor (SER), it produces 50,000 W. of heat, vaporizing mercury to drive a turbo-generator, and has been successfully operated at full power. The accompanying artist's impression shows the reactor as it might appear installed in an Agenda satellite of the Discoverer series.

Powerplants of this kind are expected to find a ready application in active repeater satellites now being developed for communication purposes, especially television.

News of Industry

Aircraft Galley Units by Field

A NEW low-cost basic galley unit for transport aircraft has been designed and manufactured by Field Aircraft Services, Ltd., working in collaboration with Charles Butler Associates Design for Industry, Ltd. By simple alterations and the addition of multiples of the basic unit, the equipment can be installed in any transport to provide the required catering capacity.

The Field Aircraft Services basic galley unit for transport aircraft. Fitted into the fuselage by means of the seat rails and overhead attachment points, it weighs approximately 150 lb.

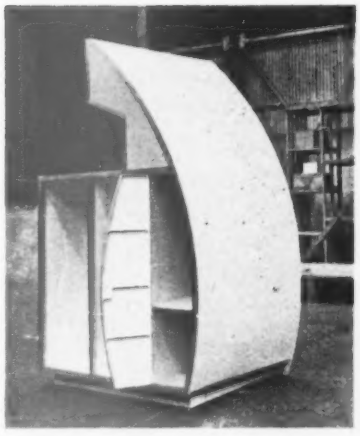
The principle of its design has been to keep the number of component parts to a minimum, and wherever possible right- or left-handed functions are made using a single component. The main portions of the assembly are one-piece light-alloy end-frame channel structures routed from the solid.

These one-piece structures may be used for either one or both ends of the basic galley unit, although a lightweight metal sandwich bulkhead would generally be used for one end. All the interior dividing partitions are manufactured from similar sandwich material and rebated into the end frames.

All cupboard doors and drawer fronts are also made from the solid by routing, and inlaid with Formica on all outward surfaces. The working top, sink unit, and work-top surrounds are of stainless steel and designed to be free from dust traps.

In addition to the cupboards and drawers in the base of the unit, an additional stowage compartment is installed above the working top. Fitted with sliding doors, it is directly above the switch control panel, leaving enough space for accommodation and operation of all electrical equipment such as hot cups on the working top. A large waste container is provided with access through the back of the unit behind the sink.

Fitted into the fuselage by means of the seat rails and overhead attachment points, the complete galley unit is 63¾ in. high, 32 in. wide and 36 in. deep. The two airlarder stowage compartments will carry 64 loaded metal trays and the top cupboard has a total volume of 1,440 cu. in. The five drawers have a total capacity of 1,814 cu. in. Empty weight of the complete unit is approximately 150 lb.



A side view showing a cupboard door routed from the solid and the bulkhead profile of the unit which can be varied to fit different fuselages.

The new galley was exhibited on the company's stand at this year's Farnborough Show, where it attracted considerable interest, both from the aircraft industry and also from other possible users, including railway companies.

Facsimile Communications

SIX teletape transceivers have now been installed in B.O.A.C.'s control centre at London Airport as part of the Creed facsimile communication system. Designed to provide high-speed communication of brief handwritten messages and other data over short distances, these machines form the hub of the system operated by the Corporation which at present comprises a total of 13 units.

Responsible for watching the movement of B.O.A.C. aircraft throughout the World, the L.A.P. control centre is manned on a 24-hour basis. It co-ordinates information about passenger and freight loads, the positioning of aircraft for changes in schedule and for the availability of crews.

For this work, five of the six teletape transceivers in the centre are used in connection with crew rosters and are linked with similar units operated by the crew roster staff of the various transport fleets. The other machine is used for communications with two other teletape transceivers located at station operations and service control, both on the north side of L.A.P.

Messages to be sent by the Creed system are written in pencil on a ½-in. wide tape of Teledeltos paper carried on a writing platform fitted across the front of the machine. When the message has been written, a tape cover is closed and transmission proceeds automatically without any further action on the part of the sender.

Thirteen inches of tape are available for each message and the transmission time for each length is 18 sec. Messages are recorded on the tape exactly as written by the sender, and reception is completely automatic.

Creed teletape transceivers in B.O.A.C.'s control centre at London Airport. Each unit can send or receive hand-written messages up to 13-in. length within 18 sec.

VC10 Hydraulics

MANUFACTURED under licence in this country by the Sperry Gyroscope Co., Ltd., hydraulic pumps and motors designed by Vickers Inc., of Detroit are to be fitted in the Vickers VC10s for B.O.A.C.

Four Vickers variable-delivery pumps are to be installed in the aircraft for providing the power supply for the main hydraulic services—comprising power flying controls, undercarriage selection, nose wheel steering and brakes. Sperry are also supplying Vickers relief valves, as well as auxiliary pumps to boost the hydraulic fluid to the main pumps.

Six hydraulic motors are to be fitted to each VC10. Four are mounted centrally in the fuselage for leading-edge slats and flap operation, and the other two are in the tail for tailplane incidence control.

The pumps—type PV3915—have a flow of 15 Imp. g.p.m. at a pressure of 3,000 p.s.i., and weigh approximately 16½ lb. The Vickers motors operate at 3,250 r.p.m. and have an output of 21½ h.p.

Personal Flying

Most light aeroplane pilots wisely cross the Channel at its narrowest point, in single-engined aircraft. The bolder ones sometimes fly direct, regardless of the longer sea crossing. Few of these, however, would relish crossing, say, the North Sea to reach Holland rather than flying along the coast. Fewer still would fancy crossing the North Atlantic, even via Iceland and Greenland.

How many would like to fly across the South Atlantic non-stop in a single-engined lightplane? And having done it once, how many, finally, would relish repeating the feat a few weeks later. Max Conrad, as we mentioned a week or so ago, has done just that. And details are now available of his latest record-breaking flight in the 180 h.p. Comanche.

He sat on a seat which itself was filled with fuel, for over two days, from November 24-26, and droned on and on for just 41 miles short of 7,000 miles. This was a new record for Class 3 aircraft weighing less than 3,858 lb., which his Comanche did by some 20 lb. With 50 Imp. gal. of fuel in the wing tanks and four cabin tanks (including the seat), he had a total of 308 Imp. gal. on board.

His fuel consumption was such that after 56 hr. and 26 min. in the air, he landed with a further 10 hours' fuel on board. His average consumption was only 4.8 Imp. gal./hr. for an average speed in an east to west direction of 127.15 m.p.h., giving an a.m.p.g. of 26.4. The remarkable thing about this consumption was that it was achieved on a fully rich mixture, at altitudes varying from 100 ft. by day, and 500 ft. by night. Oil consumption was four quarts, added in flight by a special system.

On take-off at Nouasseur, 30 miles east of Casablanca, the Comanche had an overload of 1,288 lb. To avoid taxi-ing with this load two miles to the downwind end of Nouasseur's 12,000-ft. runway, Conrad took off with a slight cross- and down-wind component, after approximately 3,500 ft. on less than full throttle. He was airborne at 90 m.p.h. and cruised initially at 125 m.p.h., reducing gradually to 100 m.p.h. with the decreasing fuel load.

He considered the flight generally without incident, except for a few thunder showers. Headwinds of 20-25 knots were encountered throughout the Caribbean and Gulf of Mexico, and he had to climb to 4,000 ft. to clear Haiti. Customs complications decided his eventual landing at El Paso.

Throughout the trip, he used the Piper Auto Control automatic flight system, and ARC ADF, Collins VHF and a Sunair HF transmitter/receiver. He carried no food, and subsisted on vacuum flasks of coffee, tea and hot water.

Apart from the fantastic personal achievement of Max Conrad, this flight was an extraordinary demonstration of the efficiency of modern light aeroplanes. Nor was it an isolated stunt. In addition to his previous record of 7,668 miles in June, he undertook "routine" ferry flights of Comanches to Honolulu(!) and Dublin immediately before the recent record. Oh yes, and he flew Comanche N110LF non-stop 3,500 miles from Bermuda to Casablanca to position it for the record return.

Gliding Notes

by Dr. A. E. Slater

SURREY Gliding Club had its 21st birthday party on Dec. 4 at the Eccleston Hotel, near the Kronfeld Club. Members heard from the club's "mother," Ann Welch, how it began in late 1938 on the North Downs just west of Reigate, with the help of a £300 cheque from the Redhill Flying Club. Before that there had been a few try-outs of the site, including a highly successful Whitsun meeting organized by Ann, with a view to making it possibly a branch of the London Gliding Club, for use in south winds. But the London Club lost interest, so Ann started a club there herself and had acquired 31 members by the end of the first week's flying. After 10 months the membership had grown to 128, when the War clamped down on it until 1946.

As Hugo Trotter, the chairman, reminded the diners, this was not the first Surrey Gliding Club. Like the present Midland and Kent Clubs, it had a predecessor, founded in 1930 and entirely unconnected with the present club. I was a member of this early Surrey Club for a few months, and got my British "A" certificate with it, touching down rather suddenly on wet plough with the skid and one wing-tip while in the act of trying to turn into the wind before landing. But it counted as a "normal landing" for "A" certificate purposes.

* * *

The two Surrey Clubs have had curiously parallel histories in some respects. Both moved eventually into Hampshire. And the first one lost its identity by amalgamating with various clubs on the South Downs to form the Southdown Gliding Club, which still flourishes. The present Surrey Club has not lost its identity so far, but with the formation of the Lasham Gliding Society some months ago it gave up control of Lasham Gliding Centre.

However, Lionel Alexander, speaking at the anniversary dinner, described the club as having "for practical purposes ceased to exist," and Ann Welch called it "a shadow of its former self," saying that anyone at 21 years of age "ought to be in a much more vigorous state of life"; while Frank Irving, claiming that the Imperial College Gliding Club is "the senior club at Lasham" (loud boos, but it is true), hinted that his club may soon be doing its primary training elsewhere. So there will not be a second Imperial College Club, even if a third Surrey Club arises. Nobody spoke for the Army Gliding Club, which was installed at Lasham before any of the other clubs arrived; but it has now become, officially, a local branch of the Army Gliding Association which was formed early this year.

* * *

Gliding has sometimes been called "not a sport, not an occupation, but a way of life," and even in Switzerland I have heard it described by a long German word with an equivalent meaning. Frank Irving took the same view when, at the dinner, he warned that the new Lasham must not only train its pupils but imbue them with the traditional atmosphere of gliding, which he likened to the magic garden found by the boy who opened "The Door in the Wall" in H. G. Wells' famous story.

I have just had another look at it (the story): when the boy grew up, he saw the same magic door again three times, at long intervals and in different places. But on each occasion he was hurrying to an important appointment which furthered his success in life, and he resisted the temptation to go in.

I have known many people from the early gliding days who subsequently made successful careers. Some have acted like H. G. Wells' character; many still open the door to take short peeps inside; but only a favoured few, like full-time instructors, have gone right in and have stayed there.

Though the date of this party, Dec. 4, was not exactly the 21st birthday of the Surrey Gliding Club, which started flying on Nov. 12, 1938, it was the 30th anniversary, precisely, of the famous "Gliding Lunch," organized under the auspices of THE AEROPLANE, at which the British Gliding Association was formed.

The year 1929 was notable for the progress of cross-country soaring in Germany, where nearly all the soaring hitherto had been done over the windward slopes of hills. Robert Kronfeld, in particular, raised the World's height record to 8,494 ft. and the distance record to 93 miles in a flight from the Wasserkuppe to Bayreuth on July 30 that year. So THE AEROPLANE published a special Gliding Number on Nov. 6, 1929, and among those who were thereby stimulated to write in was Douglas C. Culver, a pilot of the First World War.

Mr. Culver suggested a lunch where all those interested could confer on the best means of reviving gliding in England, where it had died out after a single soaring contest in 1922. The lunch was held at the Comedy Restaurant, where seats were booked for 25 people and 56 turned up.

Those who wanted to organize gliding founded the B.G.A., and those who wanted to glide themselves got together later and founded the London Gliding Club and the Kent Gliding Club, the first having, I believe, one day's priority, but I did not contact it till its first public meeting in February, 1930. Everybody else present at that meeting, and all who were at the Gliding Lunch (which I missed), have renounced "The Door in the Wall," though one or two—not more—can very occasionally be seen peeping furtively through the keyhole.

* * *

(The present editor of THE AEROPLANE AND ASTRONAUTICS as organizer of the lunch still feels he did the right thing even if he can only "peep through the keyhole."—ED.)

Correspondence

A.T.C. Officers—Good Types

I HAVE read with interest the article by Mr. Norman Jones in your issue of Nov. 20, and I find it very difficult to understand just what Mr. Jones is driving at. At first glance, it seems that he is suggesting that the Air Traffic Control Regulations be scrapped! Another thing I notice is that horizontal visibility is not mentioned.

Does Mr. Jones think that it is a good thing to have inexperienced pilots floundering around Control Areas in a visibility of less than a mile? If this is so, how would he feel if he were a passenger in an airliner making an ILS approach in really bad visibility knowing that there might be any number of light-hearted and enthusiastic pilots flying on a collision course and relying solely on their seeing his aircraft in time to avoid a crash. Makes you think, doesn't it?

I find it very difficult to follow Mr. Jones' line of reasoning when he tries to relate the case of aircraft flying close together, in the same direction, each clearly visible to the other, with two motorcars passing each other at 70 m.p.h.; particularly when he points out that aircraft move in three dimensions.

We, at Denham, find the Air Traffic Control Officers both at London Airport and Northolt most helpful. They will do everything possible to enable us to carry on flying when the visibility is bad and the cloud base is low.

Denham, Bucks. D. C. G. WRIGHT,
Denham Flying Club
(Chief Flying Instructor).

Kingsford-Smith's Last Flight

ALTHOUGH I cannot answer the specific questions raised in Mr. Tyrrell's letter to you of Oct. 23 last regarding Kingsford-Smith's "Lady Southern Cross," I wonder whether he knows the remarkable coincidence that had occurred over the Indian Ocean during Kingsford-Smith's last ill-fated flight. Another aircraft, a Comper Phœnix, flown by a young Australian pilot whose name escapes me for the moment (but who took part in the Australia races and became quite well known in civil aviation and who was subsequently killed in Australia) was also on the same course flying to Australia. He told me that in the middle of the night over the ocean Kingsford-Smith's aircraft passed over the top of him with only a few hundred feet to spare, so close that the exhaust flames were visible. Some time after that Kingsford-Smith must have been lost as he never made his next land-fall.

New York 20, N.Y. CHRISTOPHER CLARKSON.

[It does not seem likely that Mr. Jimmy Melrose was flying a Heston (not Comper) Phœnix in the incident mentioned by Mr. Clarkson. "Smithy" first took off from Croydon on his record-breaking attempt at 07.00 hrs. on October 23, 1935, but had to return. He left again on Nov. 6 of that year. On Nov. 2 (four days earlier) Jimmy (Charles James) Melrose left Croydon in a Percival Gull (Gypsy Major) accompanied by Harry Broadbent in a Percival Gull (Gypsy Six). Kingsford-Smith was accepted as missing by the Air Ministry by Dec. 11, 1935, after passing Calcutta on Nov. 7 for Singapore. It was not until the following year, on April 9, 1936, that Melrose took his Phœnix out to Australia. Jimmy Melrose was killed on July 5, 1936, in Australia.—ED.]

Kingsford-Smith's Altair

HAVING read with considerable interest Mr. Monty Tyrrell's letter published on Oct. 23 last, I think I can at least give him some assistance in his "gen" required on the most famous Altair built, namely, the much-record-breaking and finally ill-fated VH-USB, originally named "Anzac."

When the Altair arrived as ship-cargo in the U.K. (from New York), in August or early September, 1935, it was registered VH-USB. She became G-ACUS in October, 1935: the main reason for its registration on the U.K. Register was apparently because when the aeroplane arrived in England (from storage in the U.S.A.) it did not possess a valid C. of A., either by the American or Australian authorities! And it took Smithy five whole weeks to get a U.K. "limited C. of A.," reducing the Altair's original petrol tankage from 500 U.S. gals. to a mere 118 (Imperial) gallons.

I have no knowledge of the ship on which the Altair was carried from New York to England, but I am quite sure it was not flown across the U.S.A. by Smithy prior to being shipped to England!

"Pacific Flight" by Capt. Sir P. G. Taylor (originally published in 1939 in the U.K.) and "Smithy" by John Stannage (published by Oxford University Press in 1950) contain much information.

John Stannage's book records the discovery made in May, 1937, of one of the Altair's main wheels and oleo-leg, off the bank of a small island, just off the Burma coastline. After a most painstaking and thorough investigation, these parts were established beyond all doubt to belong to the Altair.

Mr. Tyrrell should try to contact Mr. John Stannage through The Aero Club Federation of Australia, 108 Queen Street, Melbourne, Victoria. I reckon, with luck, your correspondent will then be able to get "all the gen" he wants.

Nairobi, Kenya. DENNIS M. POWELL.

[1. According to THE AEROPLANE of Oct. 16, 1935, Kingsford-Smith arrived at Croydon on Oct. 8 with his Lockheed Altair. It was off-loaded on to a barge and taken ashore at All Hallows, on the Kentish bank of London River, and thence flown to Croydon. In those days All Hallows was used by Rochester residents as a bathing resort.

2. The name of the ship unknown.

3. Method of transport across States unknown.

4. Australian registration not known to us, but a complete J. H. Clark drawing of the machine and its retractable undercarriage on page 462 of that issue shows the registration letters to be G-ADUS.—ED.]

Groundabout

Smiling, the boy fell dead. Well, we're back at the coal face after that 6-week, 35,000-mile round-the-World thrash. Let me recall a few of the many endearing moments. Going out, I was rated by B.O.A.C. as an "I.P.", a diminutive of "V.I.P." and a means of preparing the crew for a quota of queer questions. The letters probably mean "Inquisitive Person" or, as jolly old Wren laughingly brushed it off, "Insignificant Pressman." Coming back, I was exposed to the full Qantas treatment. Like B.O.A.C., they injected champagne and caviare at frequent intervals (after all, you can't be more First Class than Seat No. 1A, what?) and when, Pacifically poised, I asked Chief Steward Kidd, in an off-hand way, if I was rated "I.P.," he replied "Sir, *all* our passengers are regarded as important persons." Smooth lot, these Aussies, bless 'em.

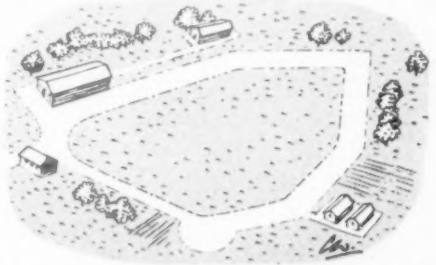
*

The Pioneering Spirit. Antipodean rain beat down on Wellington Airport, washing out the flying display for the day. I met and commiserated with Doug. Patterson, the organizer. But, by Gad, sir, they're a tough lot, these Colonials*. "I'm all right, Chris," he said, "I've got water-tight ulcers."

*Humour.

*

Puzzle Corner. In Heraldic flight near Blenheim, New Zealand, I made this quick sketch of a strange set-up on the ground. What was it? Perhaps our



old friend Leo White, who has photographed every inch of New Zealand from the air, can explain? Personally, I think it's an airfield especially designed for engine-out take-offs.

*

Point of No Return. In Melbourne, an airline friend, who I think would prefer to be nameless, introduced a stewardess, who I *know* would prefer to be nameless, in this way: "This is our oldest stewardess—sorry, I mean our most *experienced* stewardess."

*

Down Under. Messing committees who are contemplating the purchase of a new carpet for the bar should take a tip from the beauty in the Woomera Mess—it has built-in beer stains.

by Gordon

NOTES AND EVENTS

OFF TO AMERICA.—The Mayor of Swindon, Ald. F. D. Jefford, congratulates Mr. M. Church, who has been selected by The Plessey Co., Ltd., for a six-month tour of America to study engineering techniques. Here (left to right), are Mr. Church; Mr. A. E. Underwood, Plessey director; Ald. F. D. Jefford, and Mr. F. B. Langworthy, this year's best apprentice.

DATA PROCESSING.—A new high-speed electronic data-processing system known as Orion, claimed to be one of the fastest and most powerful of its type in the World, is currently under development by Ferranti, Ltd. The system is fully transistorized and incorporates the latest Neuron logical elements enabling complex systems to be built around the central computer with the minimum of components.

ORDER FROM SOUTH AFRICA.—A substantial order for multi-channel high-power communication equipment has been placed with Plessey International, Ltd., by the South African High Commissioner in London. The equipment will be installed in ships of the South African Navy for ship-to-ship and ship-to-shore communication.

LIFERAFTS FOR S.A.S.—A £24,000 order has been placed by S.A.S. for the recently introduced 24-man inflatable rubber liferafts made by R.F.D. Co., Ltd., of Godalming, Surrey. The liferafts are to be used on the airline's DC-8 aircraft.

TRANSISTOR POWER.—The telecommunications division of Elliott Brothers (London), Ltd., announces that it has developed a new range of transistorized power supplies which provide a pure waveform at high efficiency and which could be used in place of rotary units. The range also includes power packs to replace vibrator inverters providing square-wave AC, or high-voltage DC. Using this range, it is now possible to meet the power requirements of almost all radio, communication and aircraft equipment.

A BOOK TO GET

"Electronic Flash Photography" is the title of a book by Ralph L. Aspden, published on December 9 by Temple Press Limited. In this book Mr. Aspden, who is responsible for high-speed photographic research and development at the Royal Aircraft Establishment, surveys the principles and practical techniques of electronic flash photography in industry, in the field of research and in radiography. A number of chapters in the book are devoted to the application of ultra-high-speed photography to aeronautical research work.

Containing 192 pp., 8½ in. by 5½ in., this book can be obtained from booksellers, price 37s. 6d., or by post direct from the publishers at Bowling Green Lane, London, E.C.1, price 38s. 9d.

TEN YEARS OF DECCA.—Decca Radar, Ltd., has produced a book describing the first ten years of its radar experience and development. The publication has sections dealing with Decca's contribution to the aviation field. This includes equipment for use in civil operations, air defence, meteorology, display and data handling.

Aviation Calendar

December 29.—The Radar and Electronics Association lecture, "High Quality Sound Broadcasting," by K. R. Sturley, at the Royal Society of Arts, John Adam Street, Adelphi, **London,** W.C.2, at 19.30 hrs.

December 29.—Institute of Transport lecture, "The Work of the Federal Aviation Agency in the U.S.A.," by Thomas T. Carter, in the Conference Room, 3rd Floor, Control Tower, **London Airport Central,** at 18.30 hrs.

January 4.—R.Ae.S. Boscombe Down Branch lecture, "Escape from Military Jet Aircraft," by Wg. Cdr. J. Jewell, in the Lecture Hall, A. and A.E.E., **Amesbury,** Wilts, at 17.30 hrs.

January 6.—R.Ae.S. Brough Branch lecture, "The Art of Developing Aero Engines," by A. C. Lovesey, at the Royal Station Hotel, **Hull,** at 19.30 hrs.

January 6.—R.Ae.S. Weybridge Branch lecture, "The Work of Vickers Research, Ltd.," by Dr. J. R. Green, at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., **Weybridge,** at 18.10 hrs.

January 7.—R.Ae.S. Young People's lecture, "Flying and the Human Machine," by Dr. G. Melvill Jones, at the Royal Society of Arts, John Adam Street, **London,** W.C.2, at 15.00 hrs.

January 8.—Helic. Assn. of Gt. Britain lecture, "The Development and Flight Testing of Helicopters," by J. Sarsted and A. V. Coles, in the Library, 4 Hamilton Place, **London,** W.1.

January 9.—British Interplanetary Society, film show, in the Lecture Theatre, Science Museum, Exhibition Road, **London,** S.W.7, at 19.00 hrs.

Company Notices

NEW COMPANIES

Stubington Enterprises, Ltd. (642,966).—Private co. Reg. November 25. Cap. £100 in £1 shs. Objects: To carry on the business of aircraft piloting and maintenance contractors, etc. Directors: Frank C. Stubington and Lesley L. W. Howe, both of 138A Bensham Lane, Thornton Heath. Sec.: Lesley L. W. Howe. Reg. office: 14 Pall Mall, S.W.1.

Air Safaris, Ltd. (643,059).—Private co. Reg. November 26. Cap. £100 in £1 shs. Objects: To carry on the business of aeroplane enterprises and aviators, travel agents, postal and general contractors, etc. Directors are: William E. Hamilton, 110 Kingswood Chase, Leigh-on-Sea. Casimir M. de Bouneville, 3 Chawten House, Alton, Hants. Sec.: William E. Hamilton. Reg. office: Grand Buildings, Trafalgar Square, W.C.2.

Birth Notices

Close.—On December 2, to Ruth (*née* Daintry), wife of Flt. Lt. W. E. Close, R.A.F.—a daughter.

Cunningham.—On December 2, at Preston Royal Infirmary, to Marion, wife of Sqn. Ldr. Derek Cunningham—a son.

Luck.—On November 29, at R.A.F. Hospital, Halton, to Jessie (*née* Donaldson), wife of Sqn. Ldr. D. C. Luck—a son.

Ongley.—On December 2, at R.A.F. Hospital, Akrotiri, Cyprus, to Molly (*née* Redmond), wife of Flt. Lt. C. G. Ongley, R.A.F.—a daughter.

Wood.—On December 3, at R.A.F. Hospital, Ely, to Diana (*née* Reid), wife of Sqn. Ldr. R. C. Wood—a daughter.

Publications Received

DICTIONARY OF AERONAUTICAL ENGINEERING.—Definitions of terms now used in aeronautical engineering. By J. L. Nayler, M.A., F.R.Ae.S., F.I.A.S. 318 pp.; 5 in. x 7½ in. Illustrated. George Newnes, Ltd. Price 30s.

WERNHER VON BRAUN.—A biography. By Heinz Gartmann. 96 pp.; 5 in. x 7¼ in. Illustrated. Colloquium Verlag Berlin. Price 4.50 DM.

B.O.A.C. BOOK OF FLIGHT.—A book about the jet age, jet travel and airliners with a foreword by Gp. Capt. John Cunningham, D.S.O., O.B.E., D.F.C. Edited by Barbara Cooper. 128 pp.; 8½ in. x 11 in. Illustrated. Max Parrish and Co., Ltd. Price 16s.

WORLD AVIATION DIRECTORY.—Volume 20, No. 2. Edition directed by F. S. Hunter. 1,096 pp.; 7½ in. x 5 in. American Aviation Publications, Inc. Price $11.00.

FAMOUS BOMBERS OF THE SECOND WORLD WAR.—The stories of the most famous of the bombers employed by Britain, U.S.A., Germany and Italy. By William Green, illustrated by G. W. Heumann. 134 pp.; 9¾ in. x 7 in. Macdonald and Co., Ltd. Price 21s.

JET PROPULSION ENGINES.—A consideration of the various forms of jet propulsion. Edited by O. E. Lancaster. 799 pp.; 9 in. x 6 in. Oxford University Press. Price 140s.

SOVIET SPUTNIKS AND COSMIC ROCKETS.—By S. G. Aleksandrov and R. E. Fedotov. 230 pp. Illustrated. Collet's list. Price 4s. 6d.

AIRCRAFT AND MISSILES.—A review of what they are, what they do and how they work. By D. M. Desoutter. 213 pp.; 8¼ in. x 11¾ in. Illustrated. Faber and Faber, Ltd. Price 36s.

ADVANCED AERO-ENGINE TESTING.—The proceedings of the AGARD eighth general assembly of the combustion, propulsion and wind-tunnel panels in Copenhagen. Edited by A. W. Morley and Jean Fabri. 298 pp.; 9¼ in. x 6 in. Illustrated. Pergamon Press, Ltd. Price 63s.

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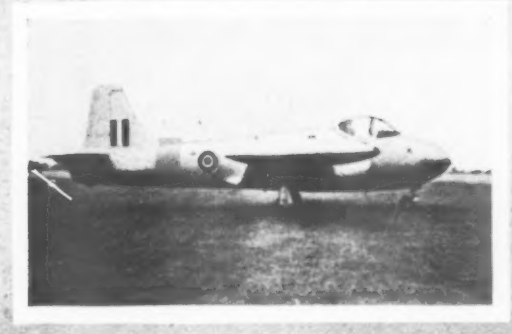

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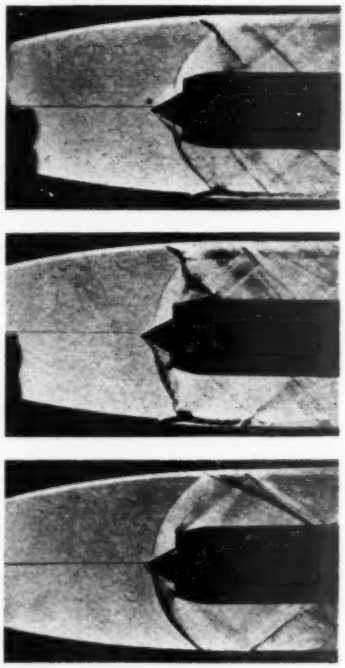

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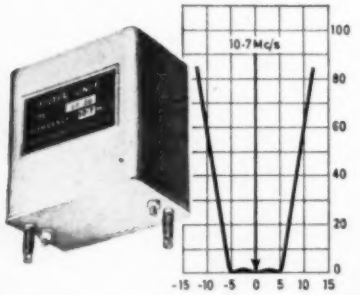

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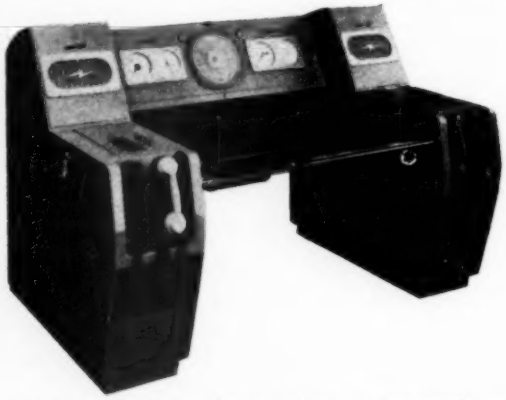

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NOTICES

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM DERBY AVIATION, LTD., OF DERBY AIRPORT, BURNASTON, NEAR DERBY:—

APPLICATION NO. 3313 for a Normal Scheduled Service for the carriage of passengers and supplementary freight on the route Staverton-Southend (tech.)-O-tend at a frequency of seven return flights weekly with Dakota aircraft, or 14 return flights weekly with Marathon aircraft, from April to October each year, for seven years from 1960.

FROM STARWAYS, LTD., OF LIVERPOOL AIRPORT, LIVERPOOL, 24:—

APPLICATION NO. 2447/1 for permission to include an optional traffic stop at Helston (Culdrose) on the following seasonal U.K. Internal Services:—

Glasgow and/or Liverpool and/or Manchester-Exeter and/or Newquay (Application No. 2447).

London Airport-Exeter and/or Newquay (Application No. 2515).

Birmingham-Exeter and/or Newquay (Application No. 2516).

Newcastle and/or Leeds-Exeter and/or Newquay (Application No. 3193).

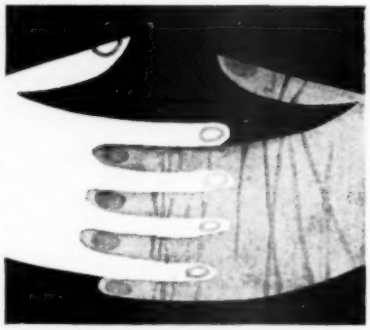
FROM ORION AIRWAYS, LTD., OF BLACKBUSHE AIRPORT, CAMBERLEY, SURREY:—

APPLICATION NO. 2589/1 for permission to operate the following services from Birmingham (Elmdon) instead of Coventry until the runway at Coventry is completed:—Coventry-Dinard: Normal Scheduled Service (Application No. 2589). Coventry-Rotterdam and/or Antwerp and/or Dusseldorf: All Freight Service (Application No. 2284). Coventry-Catania: Inclusive Tour Service (Application No. 2991). Coventry-Nice: Inclusive Tour Service (Application No. 2864).

FROM SCOTTISH AIRLINES (PRESTWICK), LTD., OF PRESTWICK AIRPORT, AYRSHIRE.—

APPLICATION NO. 1131/1 for an extension from April 30, 1960, to April 30, 1957, of the period of approval of the U.K. Internal Service which they are authorized to operate between Prestwick and Ronaldsway so as to enable them to operate the service with Dakota, DH89 and Twin Pioneer aircraft at a frequency of 12 return flights daily from May to September each year.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 513-13



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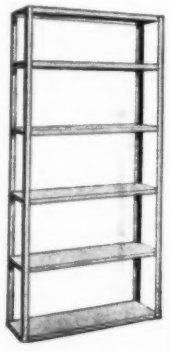

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NATIONAL Physical Laboratory, Aerodynamics Division, Teddington, Middlesex, requires Senior Scientific Officers/Scientific Officers suitably qualified in physics, engineering and mathematics, for programme of fundamental research on problems of flight at high speeds. Problems include research related to design of transonic and supersonic aircraft and flight of missiles, satellites and space craft at hypersonic speeds. Research on associated problems of physical or chemical behaviour of high temperature and low density gases also in progress. Qualifications:—1st or 2nd Class Honours degree, or equivalent. For S.S.O. at least three years' post-graduate experience. Salary ranges:—(Men) S.S.O., £1,233-£1,460. S.O., £655-£1,150. Forms from Ministry of Labour, Technical and Scientific Register (S), 26 King St., London, S.W.1 (quote A.535/9A). Closing date January 1, 1960. 513-4

BEA require licensed aircraft engineers to act as outstations engineers in the U.K. and overseas. Applicants, who must be fit for overseas service, should possess current A and C licences on modern transport aircraft. Preference will be given to applicants in possession of Viscount aircraft licences. Salary £937 10s. to £1,067 10s. per annum, plus appropriate allowances on posting. When posted overseas additional payments will be made for wife and children, including education allowances where applicable. Applications giving full details of experience and qualifications to Senior Personnel Officer, Area and Outstations, British European Airways, Bealine House, Ruislip, Middlesex. 513-7

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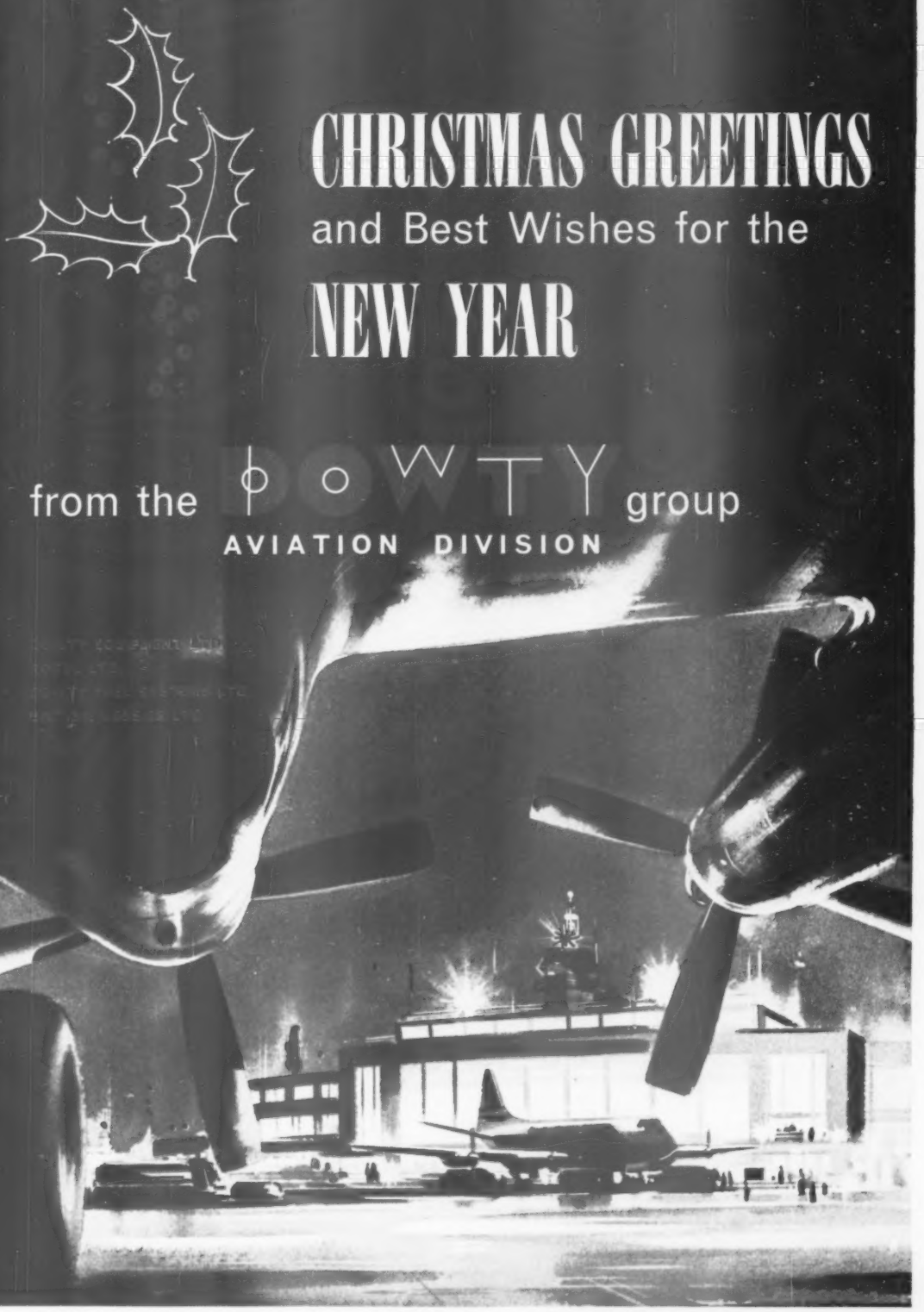
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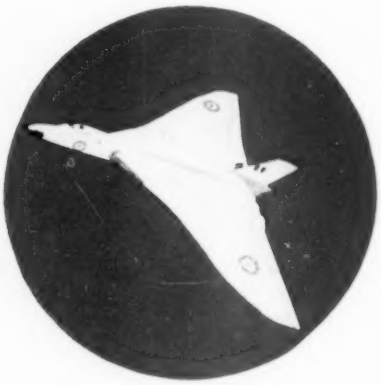

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